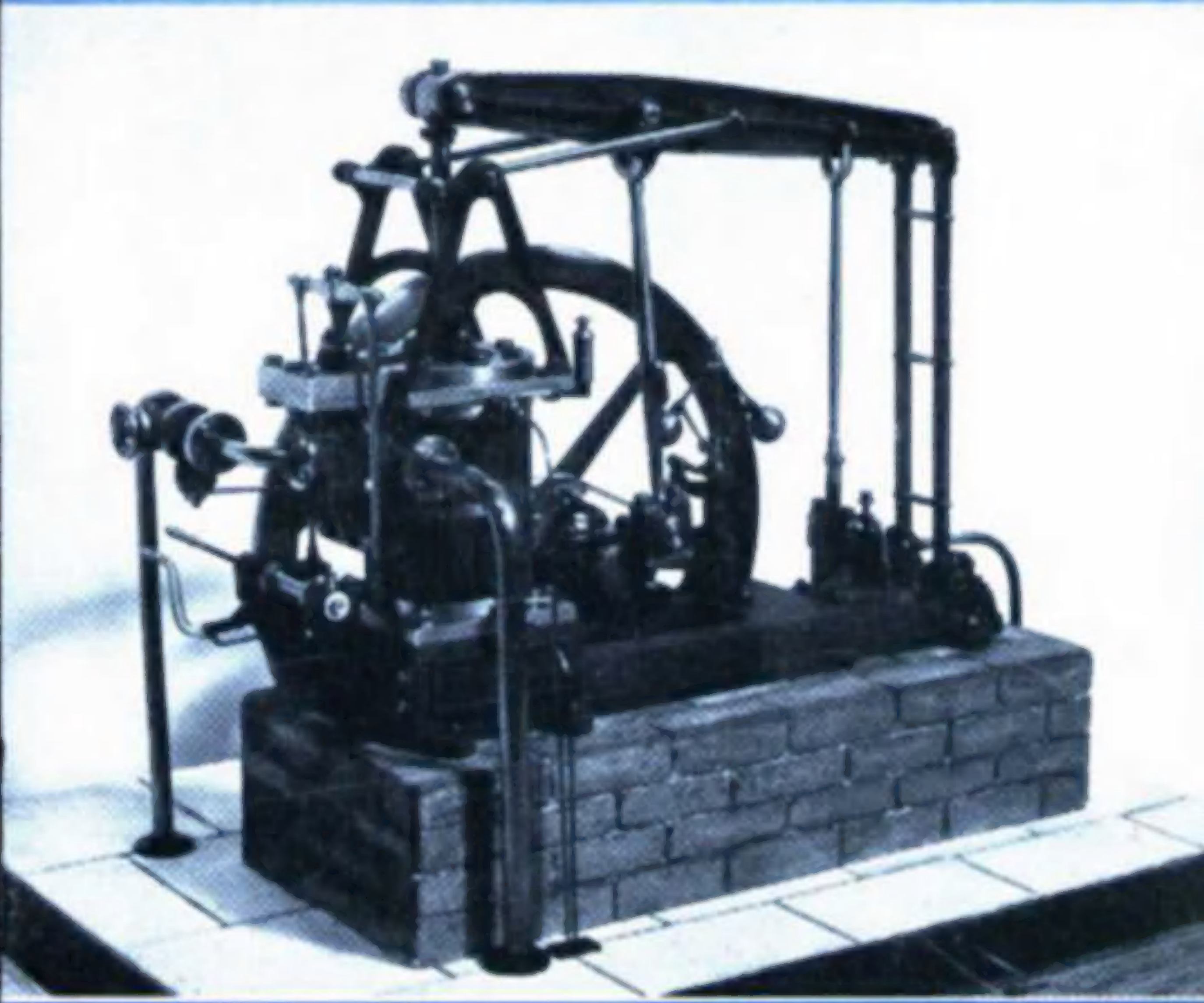
THE MODEL ENGINEER



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THE MODEL ENGINEER

EVERY THURSDAY

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Our Cover Picture

The type of engine known as a "Grasshopper" was one of the variants of the beam engine, which enjoyed considerable popularity in the early days of steam power. The origin of the design dates from very early in the nineteenth century, and the name is probably derived from the fancied resemblance of this type of beam to the hind leg of the insect in question. It was applied not only to engines with the form of overhead beam arrangement shown, but also to certain types of side lever marine engines which employed a lever of the first order. Engines of this type could be more compactly built than those with the centrally-pivoted beam, but resembled them in using parallel-motion linkage to eliminate the need for straight piston rod guides. All types of beam engines, however, were quickly rendered obsolete when the direct-acting engine became established. Our picture shows a model of a typical grasshopper engine of the type made by Easton and Amos in the 1860s, constructed by Mr. H. V. Davies, and awarded a bronze medal at this year's "M.E." Exhibition; the model was described on page 242 of our August 27th issue.

SMOKE RINGS

An Old Stephenson Model

MR. D. J. REDFERN, who supplied the photographs and brief description of the extremely interesting old model locomotive, published in the "M.E." for August 28th, 1952, has recently visited us and brought the model for us to see. We are fully convinced of the antiquity of the model; it is reputed to date from about 1810, and we see no reason to doubt this.

The original workmanship was obviously that of a craftsman, and if the missing parchment, which Mr. Redfern mentioned as giving specifications of the model, can only be found, and if it establishes the fact that the model was actually built by George Stephenson, then we have, in this model, one of the most valuable relics in the world.

History tells us that George Stephenson ridiculed the idea of road locomotion; was his opinion in this respect based on his experience with this model? The idea of applying a table-engine to a locomobile vehicle is interesting, and this model, at the moment, is the only instance we can recall. In it can be discerned the germ of the arrangement of mechanism that Stephenson employed on later locomotives, up to the year 1825; and this is a feature that supports the claim that the model is Stephenson's.

We can but hope that the descriptive parchment may soon be found; it is probably a most revealing document, apart from definitely establishing the authenticity of the model.

Models in Birmingham Museum

WE HAVE received a number of official photographs of models that are to be seen in the Museum of Science and Industry, Birmingham. They include the fine 1-in. scale Ransome's road locomotive, which was built by Messrs. A. J. Kent, F. H. Tapper and F. Moulson and exhibited by them at the 1952 "M.E." Exhibition. Others comprise: The inventor's model of James Robson's gas forging hammer of 1879; a Marshall single-cylinder overtype semi-portable engine of 1900; a Marshall compound undertype engine of 1900; a fine model of the *Cutty Sark*, and another of H.M.S. *Echo*, a ship-rigged sloop of 1782.

Among the museum's latest acquisitions is a full-size Aveling & Porter steamroller, presented by George Law, contractor of Kidderminster. This engine, which is equipped with a scarifier, is in immaculate condition and was propelled under its own steam to the museum. We believe it to be the first steamroller to become a museum exhibit; we cannot recall another.

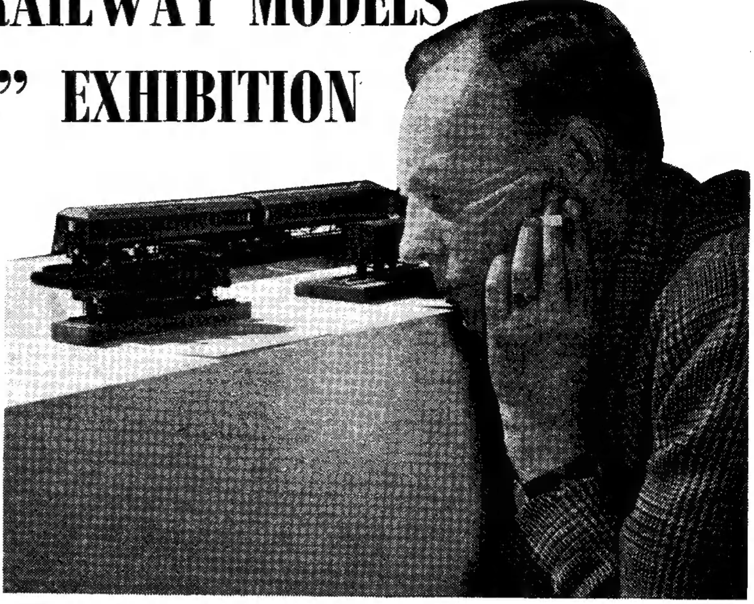
Not Quite Right

THE "SMOKE RING" under the heading "Not Her Usual Locale" in our July 2nd issue would seem to have been written under a slight mental aberration, so far as the inclusion of the words "or any other place" in the penultimate sentence is concerned. We have received a most interesting letter from Mr. J. Rangeley, of Gorton, whose father was an engineman on the old Great Central Railway and in charge of engine No. 429, *Sir Alexander Henderson*, one of the earlier "Directors." In November, 1913, this engine was stationed at Oxford, Great Western Railway, locomotive depot, and worked a regular train from Oxford to York, then York to Manchester, going out one day and returning the next day. This was in preparation for working the Royal Train from Banbury to York, non-stop, on November 24th, 1913. On this occasion, the engine was manned by Mr. Rangeley's father, and fireman W. Bennett.

Mr. Rangeley also reminds us that for seven years a G.C.R. Atlantic, No. 267, was stationed at Oxford G.W.R. depot. She worked regularly between Oxford and Leicester on through trains from the south coast to the midlands and north.

SMALL-SCALE RAILWAY MODELS AT THE "M.E." EXHIBITION

By G. M. J. Chesmore



The smaller models require close study to appreciate their finer points

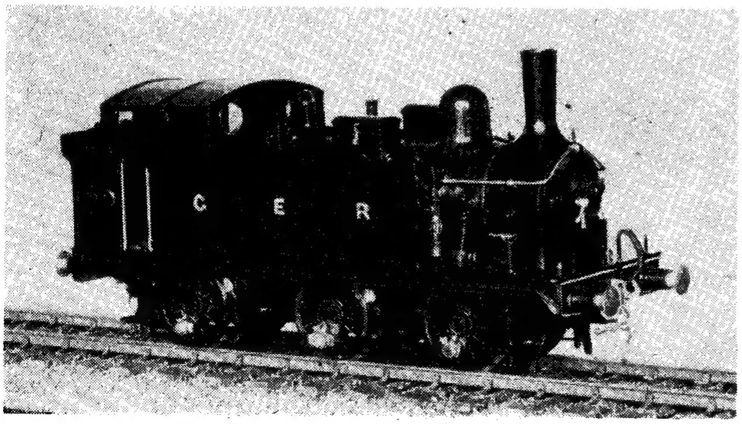
ENTRIES in Classes "B" and "C" must have pleased all model railway enthusiasts who came to the exhibition this year for, although the number of entries was down by only two compared with last year, there was plenty of good workmanship to be seen and the interest value of every exhibit was high.

All but five of the competitors worked to 4 mm. scale, most of them choosing prototypes from the four main-line groups. Against these a nice balance was maintained by seven pre-grouping models and three of British Railways standard stock.

Mr. R .S. Carter of Horley entered the first model I have ever seen of a B.R. 24-ton covered hopper wagon; quite a tricky thing to model. Mr. Carter used 28-gauge copper sheet for the hopper body and 30-gauge brass for the underframe. The prototype hoppers have very full operating instructions and other details painted on each side, and all this lettering has been reproduced by photographic reverse prints reduced to scale and carefully fixed in position, giving a very neat and convincing appearance. This model, which is to 4-mm. scale, gained a Commended Diploma.

Mr. R. J. B. King of Strood who last year exhibited his collection of 4-mm. scale pre-grouping locomotives, entered the Great Eastern representative—one of the 0-6-0 "Bucks." At the beginning of the century these sturdy little tanks handled the bulk of the Great Eastern's London surburban traffic and won almost as much fame as the more glamorous express engines. Mr. King's model of No. 372 runs on 18-mm. gauge and is powered by a 12 volt 5-pole motor driving through a flywheel and 30:1 reduction gear.

The model makes a very pretty picture in the dark Great Eastern blue with red lining and coupling rods, but here and there the paint has been rather thickly applied. The lettering is a careful copy of the prototype and the modeller has gone to the trouble of engraving the distinctive number plates which go on the bunker sides. All external details are reproduced down to hasps, staples and padlocks (but no keys!) for the toolboxes on top of the tanks. The model won a Very Highly Commended Diploma.



Mr. King's " Buck " looked very pretty in blue and red with shining metal parts

Another pre-grouping model, this time from Ealing and in "O" Gauge, was a South Eastern Railway six-wheeled 3rd brake coach of about 1890 painted in S.E. & C.R. maroon. The body has three layers of 1-mm. ply with the characteristic "bird-cage" lookout at the guard's end of the roof. Full panelling is built into the sides but a good deal more of the South Eastern character would have been obtained by rounding the corners of the framing. Undergear includes safety chains, complete brake linkage and articulated arrangement on the three axles so that the coach can comfortably negotiate curves down to about 2 ft. 6 in. radius.

Looking at this model reminded me how completely the S.E. & C.R. maroon coach livery has faded from memory. Even those old enough to have known it never call it to mind, and many people at the ex-

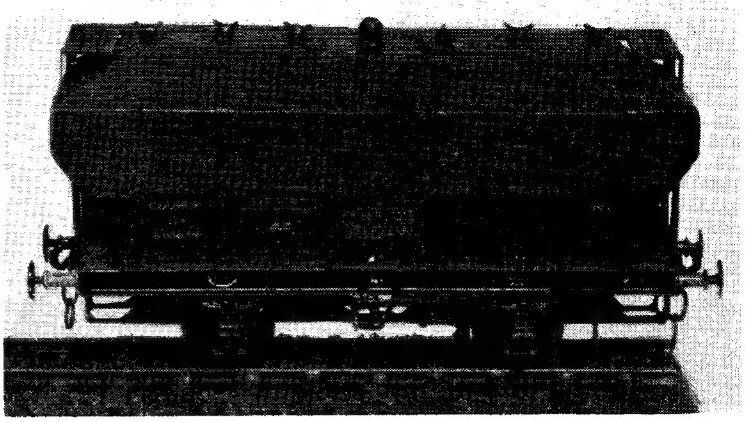
hibition must have puzzled, at first, over " that L.M.S. coach with S.E.C.R. on the side "! So thank you, Mr. Coutanche, for reminding us with your model.

Now, a most interesting model locomotive was Mr. J. B. Bentley's L.S.W.R. Adams 4-4-2T No. 488 in 4-mm. scale which gained him the *Model Railway News* second prize—interesting because Mr. Bentley has reproduced the engine as running on the East Kent Railway prior to 1946 when she was Loco No. 5.

This distinctive prototype has been cleanly modelled and well finished, the overall effect being spoilt only by the excessively thick tyres on the commercial bogie wheels used.

As a change from all the rolling stock, visitors could have a look at " Market Norton " 4-mm. scale station buildings, designed and made by Mr. R. G. Foster of Hounslow for the terminus of a West Country branch line as it might have been in about 1905, and the picturesque result is helped considerably by the period costumes which have been moulded on to the commercial castings of station staff and passengers. An air of reality is present, due to the careful placing of some objects in the most casual positions; doors half open or just ajar; a seated man halfway through the typical, but never before modelled, act of laboriously folding a newspaper! Obvious things when seen, perhaps, but requiring some imagination when it comes to modelling them.

Let's have a look at some of the Southern Railway models now. First, an unpainted and not quite complete model of *Lord Howe*. No. 857 well deserved the *Model Railway News* first prize for here was a very fine example of metalwork and soldering entered by Mr. D. A. Williams of Beckenham. *Lord Howe* is the " Lord Nelson " class locomotive which ran from 1936 until 1947 with a round-top firebox, distinguishing it from all the others in the class.

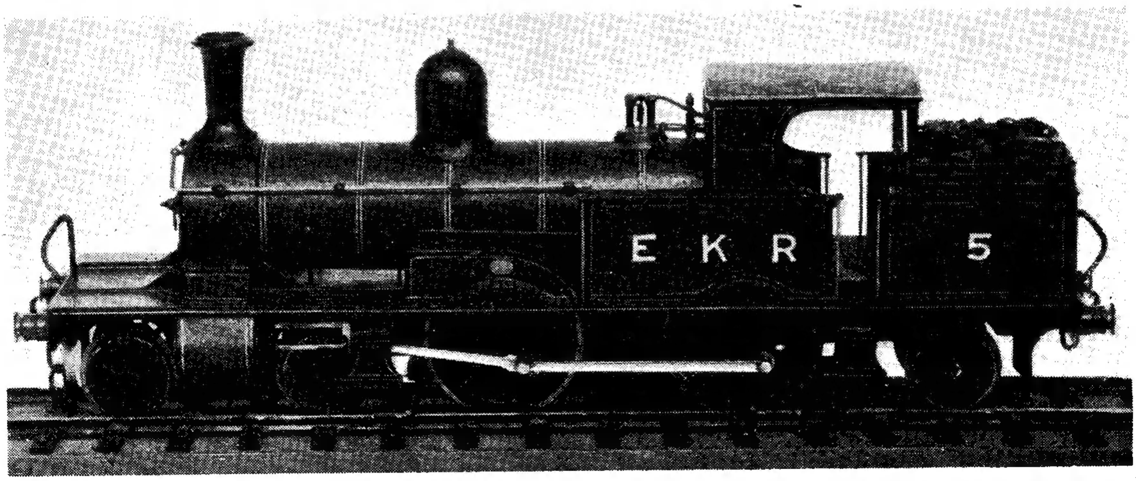


Careful sheet-metal work in Mr. Carter's covered hopper-wagon

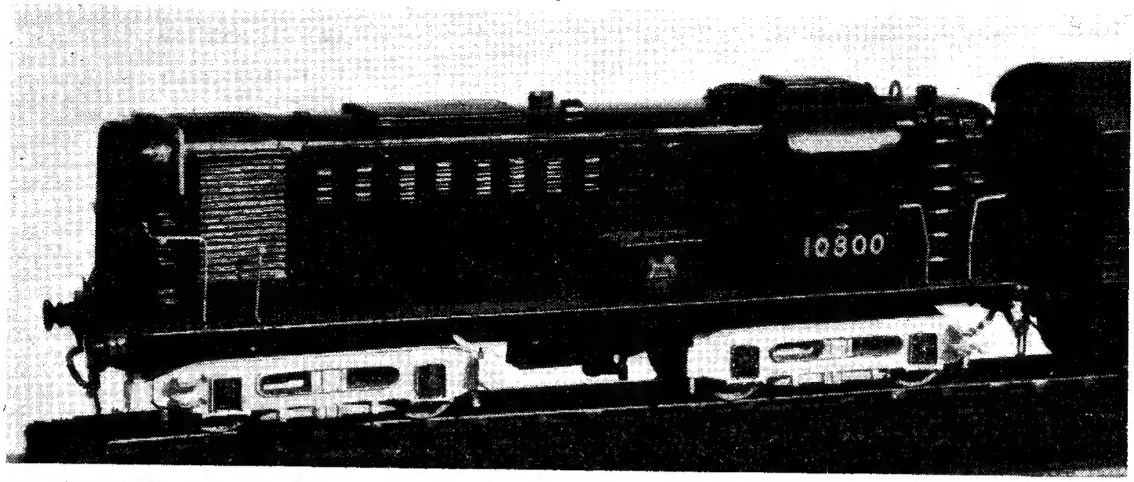
Considering that the model was built in a cramped and temporary " digs " bedroom workshop, the standard attained is remarkable. Details include full springing, brake gear and cab fittings. Furthermore, the motion work has been made with different metals to test their wearing qualities. All " Southern " enthusiasts would surely like to see this locomotive when it is finished and painted.

A very creditable first attempt in modelling came from Mr. V. R. Berris of West Dulwich, who entered a 4-mm. scale 2-6-0 " N " class mixed traffic locomotive and two bogie vans. The locomotive has a Reidpath mechanism and the general workmanship was neat though a slight loss of proportion seemed apparent. The colouring left something to be desired for, although it was nicely done, the shade of Malachite green was somewhat vivid and surely the pre-war style of lettering and numbering has been used—and why in white? Maybe these strange slips are due to lack of accurate information, or perhaps the owner just " likes it like that," in which case I would not quarrel with him except to say that any historical value a model may have is removed as soon as one begins to let fancy take charge.

Oddly enough, Mr. H. Ranger's 4-4-0 T9 also had a vivid green which



Mr. J. B. Bentley made this very neat model of the L.S.W.R. Adams " radial " tank as Loco. No. 5 on the East Kent Railway



This " OO " gauge model of the B.R. mixed-traffic diesel has yet to be motored. The builder is Mr. R. S. Carter

startled one at first. Malachite must be a difficult green to match, but at least it is well in evidence today on B.R. electric stock. Workmanship was good on the model, the tender sporting a set of fire irons and shovel, not to mention the open tool-boxes and tank cover—nice touches which help to liven things up.

But wait! Here is a 2-Bil electric unit and in this case we can say that the green does look just right. Perhaps the builder will have time soon to put a little more detail into the model, especially as regards the undergear, and to fit a motor bogie. The blue plastic hoses on the motor fronts don't quite fit the bill either.

Pullman cars always make good subjects for models, but here were not one, but four Pullmans! Quite an exercise in perseverance for Mr. P. A. Willis of Swanley, I should imagine, for every car had scale 4 in. vertical matchboarding below the waist most carefully and thoroughly scored! The two dining cars in the set had six-wheel bogies and on these too detail had not been overlooked.

The bodywork was built up of laminated cardboard with details in paper and thin card. I noticed that the heavy balsa grain on the roofs had not been sufficiently filled, always a snag when using this wood for exterior finishes on models.

Paintwork generally was well done but surely the standard Pullman colour scheme includes a little red shading in the letters to brighten things up. As it was, the absence of the red relief left rather a drab brown appearance not usually associated with these luxurious coaches. Mr. Willis' work was rewarded with the *Model Railway News* third prize.

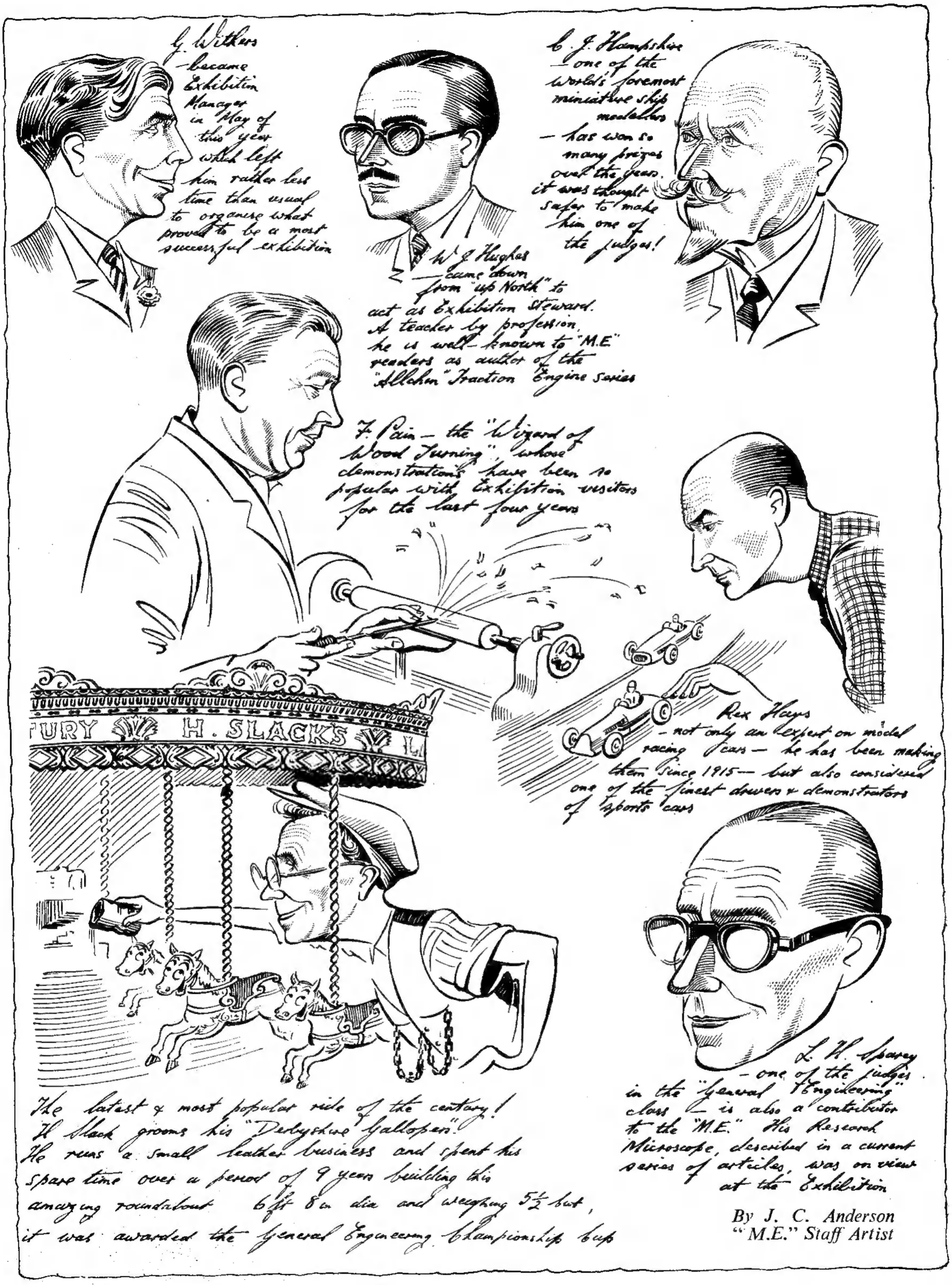
Two vans are worth mentioning before passing on to the remaining locomotives. First, Mr. L. Clow of Bromley showed a card built L.S.WR long-type horse box in Southern Railway olive green. The most notable thing about the bodywork seemed to be the planking which was perfectly straight and evenly spaced—a job requiring some skill and patience. In fact, the whole of the card construction displayed much careful knifework though the builder had partly covered up his craftsmanship with a somewhat gummy application of paint. Inside, the model was completely equipped with attendants' seats, table and other fittings. I doubt, however, whether there was a horse in there as well!

The second van was another example of careful modelling in card—and on a prototype which offers wide scope for this medium; none other than the G.W.R. 50ft. outside-framed " Siphon H " modelled in 4 mm. scale by Mr. R. S. Carter of Horley. For anyone who wants a comprehensive exercise in cardboard work I can't think of anything which has a more awesome collection of spaced planks, outside diagonal frames, end doors and so on. Mr. Carter, let me say at once, has come through the exercise with high marks and the bodywork is well supported by sufficient under gear to give a solid broadside appearance. One queer thing, however, is in the lettering, where " Siphon " has been spelt with a " y ." Correct American type bogies are fitted.

The last two exhibits which I must not leave out, were both prize-winning locomotives, both 4 mm. scale and both Great Western. Mr. E. A. Hobbis, of Birmingham, another newcomer to the hobby, has turned out a pretty " 1400 " class 0-4-2T using commercial photo-engraved parts. The most obvious fault in the model was its lack of squareness in places and especially its tendency to " sit down on its hind legs " so to speak. The painting and general finish, however, were excellent and the model received a Highly Commended Diploma.

The other Great Western model came all the way from Edinburgh in anything but G.W. territory! Mr. K. Northwood sent in this entry and won a Commended Diploma. No. 7902 *Eaton Mascot Hall* is certainly nice to look at and must have made many G.W. modellers' eyes gleam. The only slight blot on the landscape is inside the cab where part of the transmission can be seen. The engine and tender is finished in G.W. green. This, as the owner points out, is not really correct, for all the modified " Halls " are black; but he likes it like that; and come to think of it, so do I.

However, the model is of interest mainly from its mechanical features. An American Pittman D.C. 71 motor is housed in the tender and drives the locomotive wheels through a rubber band, universal joints and skew gears. No doubt some of the efficiency " hounds " would have liked to see the model in operation and this brings to mind the plea made by some that working exhibits should be judged on their performance as well as on their looks. But even if this was shown to be a good thing, it would probably be asking too much of the judges who already have a fine tussle each year. The additional facilities and time needed would make it impracticable under present conditions, though the information yielded would certainly be intriguing !



By J. C. Anderson
"M.E." Staff Artist

SHIP MODELS

at the "M.E." Exhibition

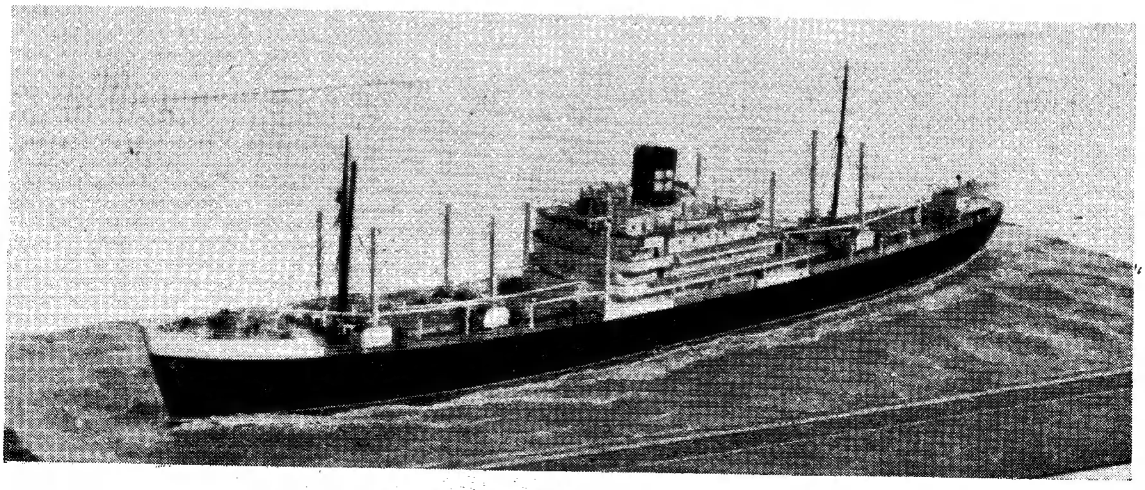
By E. Bowness

THE ship models in this year's Exhibition were on the whole well up to standard, more particularly in the miniature section. Certainly there were none of the weird creations, caricatures, distortions, call them what you will, which we have seen occasionally in previous exhibitions. The tendency toward the smaller models, already commented on elsewhere in our pages, was quite evident in the ship section, although naturally we had some examples of fairly large models.

Beginning with the miniatures, we had models from the two leading exponents of this art, Charles Hampshire and Donald McNarry. The comparison of their work is very interesting, in that, while the Hampshire models are invariably shown in a heavy sea, McNarry usually shows his under more comfortable conditions. The models are fairly equal in the amount of detail shown, and yet there is a difference. Hampshire's work is rather freer, and has more artistic licence, whereas McNarry's is precise and accurate to a degree. In scenic models such as these, either treatment is correct, as it is the expression of the temperament and characteristics of the artist. Thank goodness there is no rigid standard of perfection toward which the modelmaker must strive. Mr. Hampshire's model, which was in the loan section, was of the new Royal yacht *Britannia*, travelling at full speed through a typical Hampshire sea. With flags flying, and the feeling of fresh breezy weather, she made a very bright gay picture. Mr. McNarry's model was of the old Union Line's record breaker R.M.S. *Scot*. This was a famous ship in her day, which was before the merging of the Union and Castle Lines, and was counted a beauty even among the many beautiful clipper bowed liners of her day. Later she was lengthened and thereby lost her perfect proportions. Mr. McNarry's model shows her at anchor in a quiet sea with a boat at the foot of her companion ladder, and with an Arab Dhow in the offing. It was a lovely piece of work, and fully deserved the Silver Medal which was awarded. We understand it is going to the Union Castle Line Co.

Character and Atmosphere

A Silver Medal was also awarded to R. Carpenter of Brighton, for a very fine miniature of the M.V. *Surrey* of the Federal Line. This model also won the Hampshire prize. Although the prototype is not a particularly glamorous ship, the model had character and atmosphere, and the treatment of the sea was very effective. Another entry, of a different type, but which was also awarded a Silver Medal in the section, was that of G. H. Draper's *Naval Elegance*, a barge of 1800, a gig of 1911 and a galley of 1913. These are rowing and sailing boats, and the beauty of their long graceful lines was matched by the perfection of the craftsmanship in the models. Mr. Draper's exhibit of last year, which was on similar lines, has inspired the Birmingham experts, Messrs. Field and Pariser, to go and do likewise. Their results were exhibited alongside Mr. Draper's. A. E. Field's entry was of a carvel built yawl, and two clinker built beach boats, both of 1850, while F. A. Pariser's was the model of two ships' boats of the Nelson period, shown stowed and with bulwarks and guns below. This latter was a delightful representation of this portion of the ship's anatomy, and although the guns were hidden

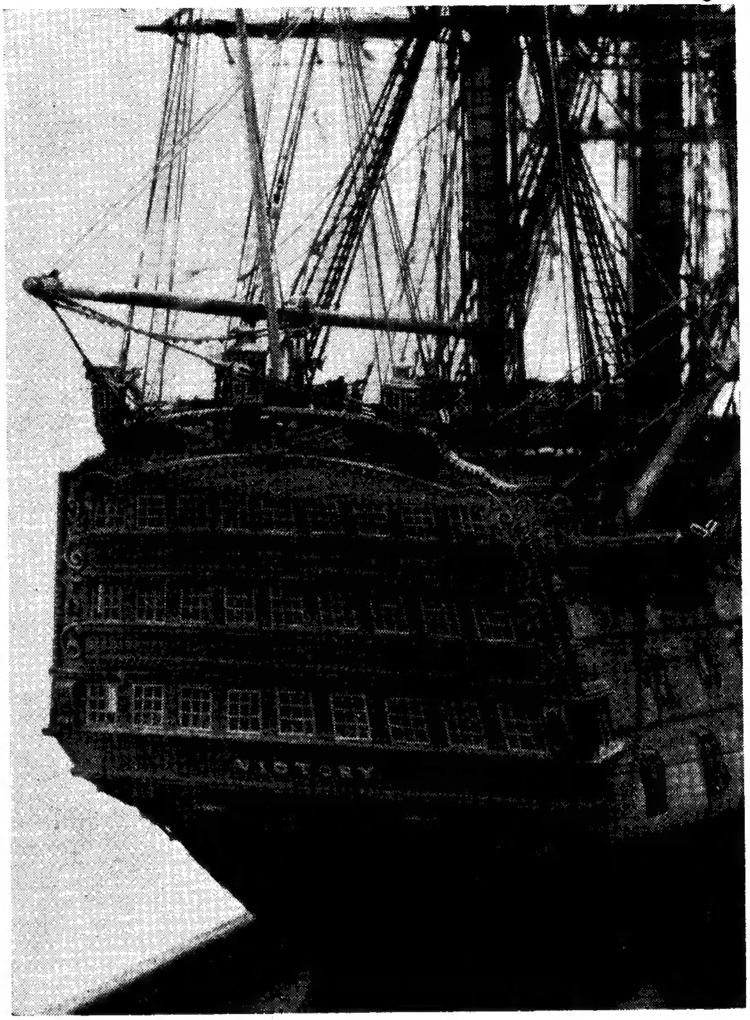


A neat miniature of M. V. Surrey, by R. Carpenter

more or less, they were quite up to the standard of the rest of the model. This entry was awarded a Bronze Medal. Mr. Field's boats were shown lying on a sandy shore, and although the planking on the beach boat was not quite up to his usual standard, the entry on the whole was a delightful piece of modelling, and well deserved the V.H.C. diploma it was awarded.

Scenic Models

E. N. Taylor of Gosport entered a scenic model of the S.S. *Pacific Unity*, passing through bridges over the Manchester Ship Canal. Here the ship was somewhat lost in the surrounding features, but it was still a very dainty piece of work. The surroundings were very carefully modelled, and were full of interest. J. L. Bowen of Manor Park is one of the few who can put detail in a model at the scale of 100 ft. = 1 in. His model of the 24,600 tons tanker *London Splendour* was nicely detailed, and his selection of what to put in, and what to leave out was very successful. Major L. C. Britton of the U.S. Army, who is at present filling an appointment in London, entered two delightful miniatures, one being of the U.S. Brig-of-War *Perry*, and the other a model of a New England Shipyard. In the shipyard a schooner was shown fitting out at a jetty, and another was shown on the stocks, in frame with building materials and tools lying around. In the background, an ox-wagon was bringing up a load of timber. The spars for the schooner at the jetty were lying alongside it, together with cases of stores and other items. When viewed from the correct eye level, the whole was a perfect picture of its subject. The brig *Perry* was a straightforward example of miniature ship modelling, and with its nice lines, slim tapering spars, and delicate rigging, was a very delightful model. Both these models were awarded a V.H.C. diploma.



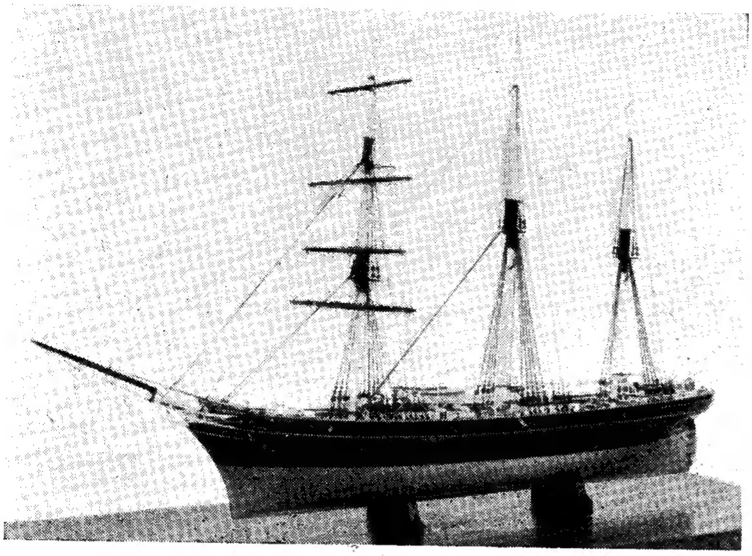
Close-up of the stern of N. Macleod's "Victory"

A Pleasant Picture

The scenic model of the river cruiser *Naiad* by A. S. Randall of Anerley, embodied what was, so far as we can remember, the first time we had seen an attempt to portray the reeds and rushes growing along the river bank. The busy (?) fisherman on the bank, the girl on the boat, and the two swimmers in the water, completed a very pleasant picture of life on the river in summer. The bottle model of the *Cutty Sark* by R. V. Gardner of Brockley, had a much better hull than is usual in these models, and with full sail set, even to the stunsails, was a very successful solution of a very difficult problem. Another miniature was the group of outrigger canoes and dugouts by W. C. Gay of Hayes. This showed evidence of a good deal of research and also of a careful selection of materials. The resultant group of models was very convincing and very interesting.

The Championship Cup in the Sailing Ships class was won by N. H. Macleod of Bognor Regis, with his magnificent $\frac{1}{8}$-in. scale model of H.M.S. *Victory*. This was a big undertaking, and one which had entailed many years of careful pains-taking work. Some of the gun port lids might have been a better fit, and the stanchions in the quarter galleries could perhaps have been rounded off a little, but the spars and rigging were very well done. We have the impression that the builder's technique and skill improved as the work went on, as is often the case in a long term model such as this. In fact, we know that the deck was re-laid when more suitable material was available, and that the coppering was re-started from scratch after many hundreds of plates had been pinned on, because the overlap was found to be arranged the wrong way. The ability to criticise one's own work is a great help in winning a cup.

The Maze Cup was won by an $\frac{1}{8}$-in. scale model of a 13th century ship of the Cinque Ports. The design was based on the *Seal of Dover* and gave indications of



Model of " Cutty Sark " when named " Ferreira "

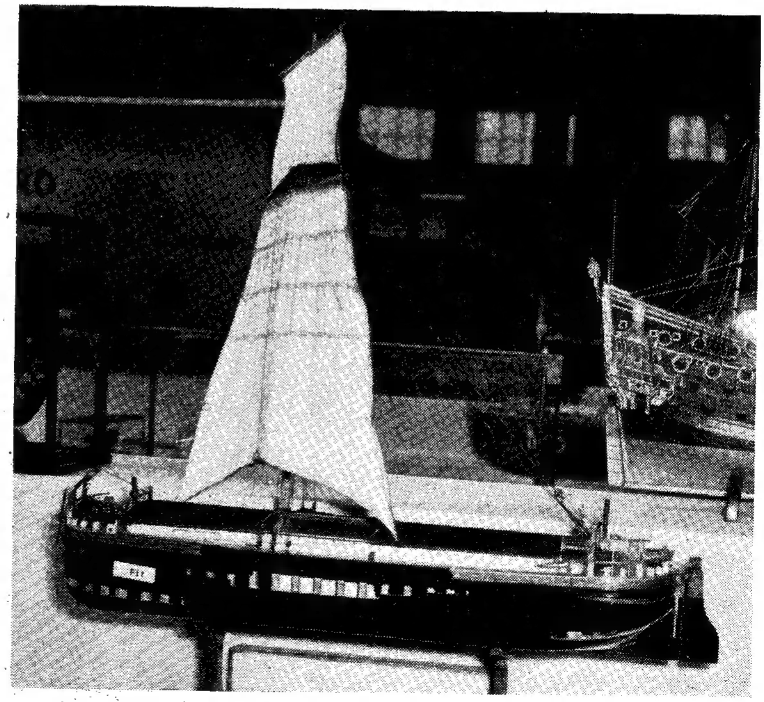
considerable research. We are not exactly happy about the pintle shown in the steering oar (nor is the builder himself for that matter), but it is at least a practical solution of a very difficult problem. Nothing we have so far been able to discover throws any light on it.

One of the finest models in the Sailing Ship Section was that of the Bengal Pilot brig *Fame*, built by R. E. Brunsden of Reading, and which was awarded a Silver Medal. This was apparently based on the plans in Underhill's book *Deep-Water Sail*. The hull form was perfect and the deck details and fittings were extremely neat—quite up to the best standard for miniature work. She was shown without sails, and the mast, spars and rigging were beautifully carried out. A plain back to the case helped one to appreciate the detail work.

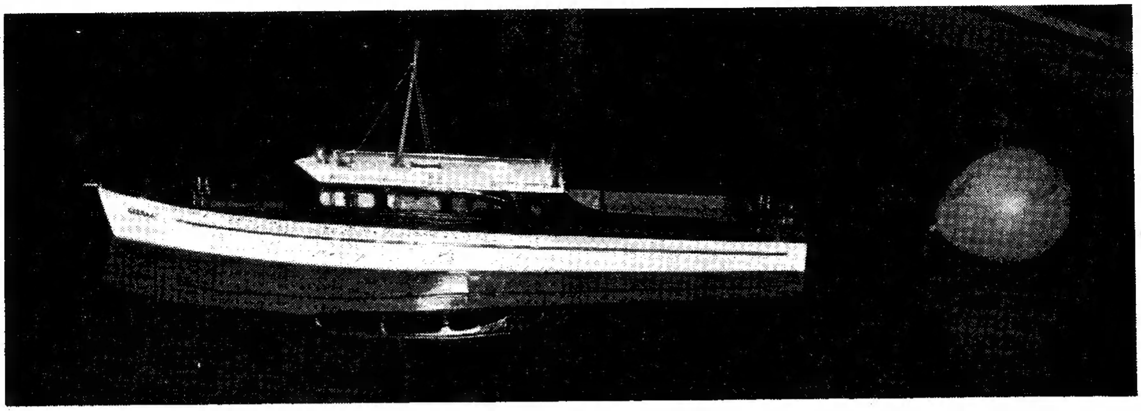
The model of H.M.S. *Prince* of 1670, by R. J. Collins, of Great Bookham, attracted a lot of attention. Its scale of 1/6-in. to the foot, makes the rigging detail a little easier, and the model is still not too big for the average house. We did not care much for the white cord for the running rigging, and there were a number of loose ends about which could have been trimmed off more closely, but the hull was a beautiful example of planking, and the gilded and painted decorations were well carried out. This model was already familiar to visitors to the Exhibition, as Mr. Collins has been demonstrating his methods in building it during the last two exhibitions. Many were interested to see it in its completed state, and congratulated Mr. Collins on the Bronze Medal he was awarded.

Another Bronze Medallist was E. Harrison of Beverley, who won the award for his model of a Humber Keel. Mr. Harrison's father owned a yard where Humber Keels were built in the old days, so he has known them from childhood. His model embodies this knowledge, and is thus a valuable piece of evidence on the subject. We understand that the Humber Keel Trust, which was formed last year to preserve information about these vessels and, if possible, to recondition one and keep it in commission, is interested in this model, and that it is going to be preserved in the National Maritime Museum. With its single mast, square sail and topsail, it illustrates well the origins of the later square rigger.

Another model, with historical interest, is that of the Shetland Sixern entered by C. J. Clarke of Birmingham. This is a direct descendant of the Viking longship, and with its lugsail, which resembles the old square sail, the similarity is quite striking. Of course, we had to have a *Cutty Sark*. This time she was shown rigged as a barquentine, as she was when in Portugese hands and under the name *Ferreira*. The hull is a very nice piece of modelling, except that the stem is curved down to the forefoot instead of straight. The butts in the deck planking are incorrectly placed and the freeing ports should be



An interesting model of a Humber Keel



"Geebaa" preparing for balloon bursting under radio control

flush with the sides. But for a few easily corrected points such as these, this model would have ranked much higher than she did. The builder, J. A. Pomeroy, of Gerrards Cross, certainly seems capable of very good work, and should win higher awards in future.

The model of H.M.S. *Theseus* of 1800 by C. A. Burton of Birkenhead shows a lot of interesting detail and the gratings and galleries are nicely made. The topmasts should, of course, have had crosstrees and the lower masts tops are incorrectly shaped. The butts in the deck planking are incorrectly placed in this model, also. C. I. Robinson of Mexborough whose sailing models of square riggers are well known, sent in a $\frac{1}{16}$-in. scale model of H.M. Frigate *Liffey*. This is a hull model, shown in frame, and is a very interesting piece of work. The stern and quarter galleries and the capstan are particularly good, but the deck planking is not very well fitted and the covering boards are omitted. The stern requires a little more study, as the fashion pieces should be horizontal with vertical filling pieces below.

Fine Model M.T.B.s.

There was no outstanding model in the Steamship Section, and the Championship Cup was not awarded. The Willis Cup was awarded to T. H. Vinnicombe, of Woodford Green, for a very nice $\frac{3}{4}$-in. scale model of a Thorneycroft M.T.B. The hull was an excellent piece of boat building, being planked on the double diagonal system.

The $\frac{1}{2}$-in. scale Vosper M.T.B., by V. R. Treeby, of Hornchurch, is a very fine model, and well deserved the Bronze Medal it was awarded. Mr. Treeby also won the M.S. & P.B. Prize of 5 gns. for the best ship model to Percival Marshall designs. The clean work and the nice matt finish was just right, and the power plant was well laid out. The engine was an E.D. adapted for water-cooling with a closed circuit and a surface cooler under the tank. The hull was built to Mr. Hughes' drawings. This is Mr. Treeby's first attempt at ship modelling, although he has had considerable experience with steam locomotives. The $\frac{1}{16}$-in. scale working model of R.M.S. *Queen Mary* by M. J. Glandfield of Richmond, Surrey, which was awarded a Bronze Medal, was well proportioned, and with its generous amount of detail, seemed too good to put in the water. It is powered by four electric motors.

An interesting cabin cruiser, which also won a Bronze Medal, was entered by Indrikis Dimza of Berwick-on-Tweed. The woodwork in the hull was of a very high order, as was also the finish—partly paint and partly polish. The i.c. engine was beautifully made, but would appear rather difficult of access for starting. Mr. H. J. Wheatland of Oxley entered a $\frac{1}{2}$-in. scale model of a Vosper M.T.B. The hull was a nice piece of work, but the paint on the superstructure was rather thick and heavy.

In the non-working steamer models, the entries were few and with one or two exceptions not of the usual high standard. R. V. Shelton of Dunstable entered a model of S.S. *Hero* shown deep-laden and in a lively sea. This was very attractive and made a lovely picture. An interesting entry came from P. T. Whitehead, an ex-*Arethusa* boy, who is now doing his National Service. He builds in cardboard and his methods were described in an article in *Model Ships and Power Boats* some months ago. This model is of the new ship *City of Port Elizabeth* and the builder's work shows great promise. E. Kilner Berry, of Worthing, sent two models of the early liners *Scot* and *Nile*. Both are clipper bowed, and the *Nile* crosses yards on her foremast. These ships had very graceful lines, and make very attractive models. Readers will remember Mr. Kilner Berry's articles in the early issues of *Model Ships and Power Boats* and it was interesting to see the actual models made by the author.

The Yachts

We had fewer model yachts this year, probably because at this time the best models are racing. The M-class yacht entered by C. H. Keeler was a very fine model, the work on the hull being first class, and the painting and finish exceptionally good. This was to an A. W. Littlejohn design, and reproduced very effectively the beauty of this designer's work. The radio controlled auxiliary sloop *Geebaa II* entered by H. R. Clayton of Chalfont St. Peter, was of a different type altogether, having been designed around the radio equipment. This had a very tubby hull with a reversed sheer. The hull finish and the internal layout was very good, and quite up to this builder's usual high standard. In conclusion, we must mention the 1-in. scale model of Sir Malcolm Campbell's speed boat *Bluebird II*. It would be both interesting and instructive to see how this model behaves in the water. It was entered by L. Oldfield of Huddersfield.

AWARDS at the "M.E." EXHIBITION

Sailing Ship Championship Cup
N. H. MacLeod, of Bognor Regis, ½ in. scale model of H.M.S. *Victory*.

General Engineering Championship Cup
H. Slack, of Chapel-en-le-Frith, 2¼ in. scale steam driven galloping horses roundabout.

Aircraft Championship Cup
Z. A. Wojda, of Whitchurch, twin engine scale control-line Polish PZL 37 bomber, with many working parts.

Club Team Cup (General)
Birmingham Ship Model Society.

Club Team Cup (Aircraft)
Enfield & District M.A.C.

M.A.T.A. Cup
D. H. Henderson of London S.E., 1¼ in. scale Chrislea C.H.3., *Skyjeep*, powered by a Mills 0.75 engine.

The "M.E." Ship Model Societies Challenge Trophy
Thames Ship Lovers Society.

The Bradbury-Winter Memorial Challenge Cup
J. S. Youngman, of Chichester, 1 in. scale model of the locomotive *Puffing Billy*.

The Maze Challenge Cup
J. W. B. Soddy, of Luton, ⅛ in. scale XIIIth century ship of the Cinque Ports, *Seal of Dover*.

The Willis Challenge Cup
T. H. Vinnicombe, of Woodford Green, ¾ in. scale Thornycroft M.T.B

The "Bristol" Challenge Cup
D. Bryant, of Brockley, 1 in. scale Bristol F2B fighter of 1916, carries markings of No. 11 Squadron.

Silver Medals
R. E. Brunsden, of Reading, 1/12 in. scale model of Bengal pilot brig *Fame*.
R. Carpenter, of Brighton, 35 ft. to 1 in. scale Federal line M.V. *Surrey*.
D. McNarry, of Barton-on-Sea, 50 ft. to 1 in. scale waterline model S.S. *Scot*, 1891.
G. H. Draper, of Ilford, three ¼-in. scale naval boats: barge 1800, gig of 1911, galley of 1913.
A. J. Kent, and F. H. Tapper, of Smethwick, 1½ in. scale 6 n.h.p. table engine.
H. J. H. Modderman, of Holland, 1/50th scale Convair of K.L.M. Dutch Airlines.
D. Bryant, of Brockley, 1 in. scale Bristol F2B fighter of 1916.
M/Sgt. C. H. Crow, Jr., of Ruislip, 1/6th scale semi-scale Piper Super Cruiser.

Bronze Medals
R. K. Boardman, of Sudbury, 5 in. gauge 1 in. scale 4-4-0 S.R. "L 1" class loco.
I. Dimza, of Berwick-on-Tweed, 1/10th scale free-lance cabin cruiser *Henry*.
M. J. Glandfield, Richmond, $\frac{1}{16}$ in. scale of R.M.S. *Queen Mary*.
V. R. Treeby, of Hornchurch ½ in. scale Vosper M.T.B.
F. A. A. Pariser, Castle Bromwich, two ship's boats on deck (Nelson period).
R. J. Collins, of Great Bookham, 1/6 in. scale model of H.M.S. *Prince* 1670.
E. Harrison, of Beverley, ½ in. scale model of Humber keel.
E. N. Taylor, of Gosport, 50 ft. to 1 in. scale scenic waterline model of S.S. *Pacific Unity* in the Manchester Ship Canal.
H. V. Davies, Morden, 1 in. scale "Grasshopper" engine *c.* 1861.
S. J. Bowles, London, N.W.10, 1 in. × 1 in. vertical steam engine coupled to centrifugal fan.
J. C. Snelling, Croxley Green, three throw plunger pump.
J. D. W. Marshall, of Hayes, Direct control autogyro, powered by E.D. 2.46 engine.
M. Hewlett, Banstead, ¼ in. scale 1914-1918 war F.E. 2D.
P. G. Cooksley, Croydon, ½ in. scale Sopwith Pup of 1917.
Capt. C. Milani, South Kensington, 1 in. scale control-line Fairey Firefly, powered by Fox 59 spark ignition engine.
E. J. Pithers, Paddington, ⅛ in. scale R.E.8 of 1914-1918 war.
J. G. Sutton, 1/20th scale Gloster G.A.5 Javelin jet fighter powered by ducted impeller.
D. Jones, Edmonton, Sailplane A.K.

Diplomas
Very highly commended, 22.
Highly commended, 26.
Commended, 24.

SPECIAL PRIZES

The Hampshire Prize
R. Carpenter, Brighton, 35 ft. to 1 in. scale Federal line M.V. *Surrey*.

The W/Cdr. J. F. Lewis Prize
£2 2s. to A. Bartlett, London, W.C.1, battery driven model of the paddle steamer S.S. *Corona Queen*.
£1 1s. to M. B. Edge, Sheffield, 1/10 in. scale Thames sailing barge.

The Reading Solid Models Society Prize
L. J. Brock, Sydenham, ¼ in. scale Bristol Beaufighter F1.

Messrs. A. J. Reeves & Co. Prize
D. B. G. Merrick, Headington, 3½ in. gauge ¾ in. scale 4-4-0 S.R. "Schools" class loco unfinished.

"Model Railway News" Prizes
No. 1 D. A. Williams, Beckenham, 18 mm. gauge 4 mm. scale 4-6-0 S.R. "Lord Nelson" class loco. *Lord Howe*.

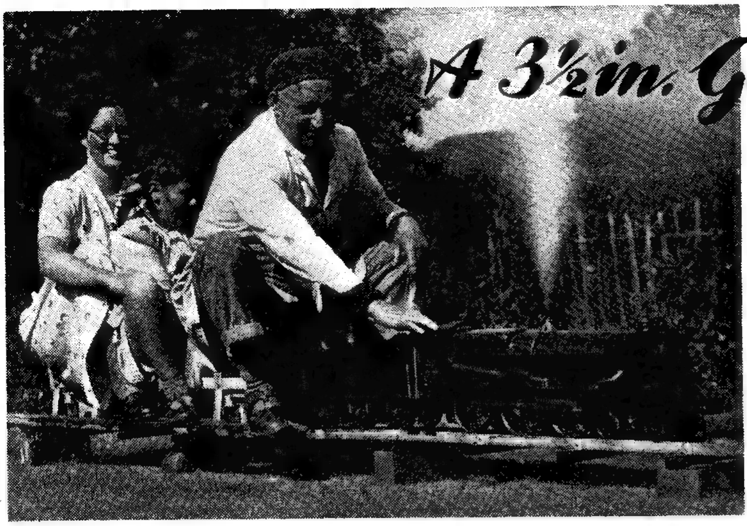
No. 2 J. B. Bentley, Bedford, 4 mm. scale 4-4-2T L.S.W.R. Adams tank No. 488, as running on East Kent Railway (Low No. 5).

No. 3 P. A. Willis, Swanley, 4 mm. scale 4 car Pullman train 10-ton passenger luggage van.

"Model Ships and Power Boats" Prize
V. R. Treeby, Hornchurch, ½ in. scale Vosper M.T.B.

"Model Aircraft" Prize
W. R. Stobart, Northampton, 120 in. span tailless glider, Kling, built to *Model Aircraft* plan.

"A 3½ in. Gauge 'King'"



By F. E. Knapp

THE locomotive illustrated by the photographs was constructed by myself just after the war. I purchased the castings and drawings from an advertiser in THE MODEL ENGINEER, (Mr. H. P. Jackson). The machining work was done on a 3⅜ Super Exe lathe, also purchased through the same advertising source.

The locomotive is not a first attempt, nor does it presume to be in the championship class.

I read the notes from the pen of "L.B.S.C.", and after building several of the locomotives which he has described, the making and fitting of the various parts becomes more or less routine.

Four cylinders are fitted, each 1-in. bore × 1¾-in. stroke, the accuracy and finish being obtained by means of a shell reamer passed through the bores as a lathe operation. Steam and exhaust ports were end-milled in the lathe, the small cutters, or slot drills, being held in 8 mm. collet chucks with which the lathe is equipped, whilst the cylinder blocks were bolted on to the boring table. By placing suitable specially made packing-pieces under each cylinder block, all ports were accurately end-milled as to positions.

The outside slide bars which are a feature on this engine class, were made by silver-soldering rectangular section silver-steel to a flat section, thus forming the web shape. It was necessary to allow the work to cool off as slowly as possible. After cleaning up and polishing, the joint hardly shows, and when fitted with the small stay-rods, look well.

The driving wheels are exceptionally fine castings of malleable-iron, and being close to scale, contribute towards the appearance of the engine.

The axle-driven pumps are two in number and are ⅜-in. bore. They are so completely reliable and efficient that no other form of boiler feed is necessary.

The crank axle commenced as a built-up assembly, but out of curiosity I machined another one from ■ block of cast-steel, 2 in. square section. I found it desirable to make a special cutting tool to machine the journals, which I described on page 388 of the issue of THE MODEL ENGINEER, dated September 18th, 1952. The time spent on this axle was well worth it.

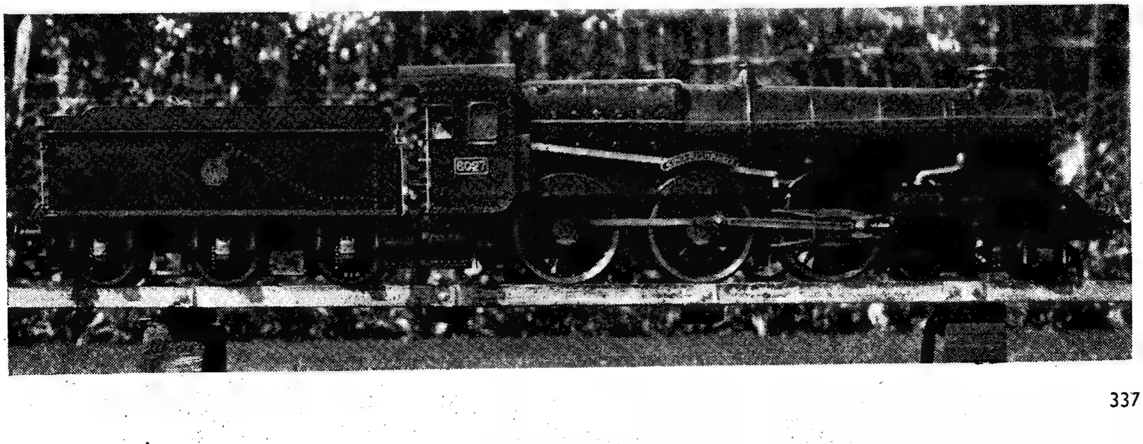
The boiler was made from 14-s.w.g. copper sheet mainly, with all end-plates flanged and riveted with ⅛-in. copper rivets at ⅜-in. pitch. The throatplate has a flange for the tapered barrel, as well as one for the firebox wrapper. The brazing medium was "Sif-cupron," having a melting temperature of 750 deg. C. No flux is required, with the further advantage that it runs through the joints. Test pressure was 250 lb. p.s.i.

The firebars are ⅜ in. × ⅛ in. section and are of stainless-steel, with the ashpan coming over the rear coupled axle. The front portion falls down on releasing ■ pin. Using small anthracite as fuel, this boiler will make steam against the four cylinders pulling on load.

The photograph shows the steam brake gear linkage disconnected, as it was in the way of the dumping of the grate.

Some careful work was put into the lagging, name and number plates. Incidentally, I did not feel equal to reproducing the full lettering and crest on the tender sides, so contented myself with the G.W.R. cipher.

The photographs were taken by Mr. John Mitchell with a home constructed camera.



READERS' LETTERS

● **Letters of general interest on all subjects relating to model engineering [illegible] welcomed. A nom-de-plume may be used if desired, but the [illegible] and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.**

A LONE HAND LOOKS AT THE EXHIBITION

DEAR SIR,—Further to the reviews of the "M.E." Exhibition which have already been published, I thought it might be of interest to have a few comments from an ordinary "lone hand."

I liked very much the extra space this year which made it so much easier to move around, but just to show what an awkward character I am, I deplored the paucity of exhibits and, especially the smallness of the tank.

While on the subject of the tank, it was only too painfully obvious that the organisers are no nearer a solution of how to afford the maximum number of people a view of the demonstrations.

May I suggest that next year the tank be constructed with transparent sides—glass, Perspex, plastic, whatever comes cheapest—and that the crowd be kept well back, at least ten feet. I think that many more would then get a view. And please, reduce the long pauses during which nothing is happening. It *can* be done !

Another grumble: the Grand Prix track this time. The "genius" who conceived the idea of building it along two sides of a right-angle should, as a penance, be made to braze the boiler for a 7-in. gauge locomotive in the hothouse at Kew while wearing winter underwear, an Irvine jacket and a knitted cap comforter. A more awkward spot for the viewing public could not have been found. Surely, it is elementary that the crowd should be able to assemble *all round* such an exhibit.

The demonstration area was very good; possibly the brightest spot of the lot. Next year, could the rails be topped by boards twice the width of the uprights ?—"Elbows, for the use of."

On the trade stands; my Mecca was the Myford stand, where I wanted to see both the M.L.7 and the Super 7 operating. Despite almost hourly promenades in the vicinity, I did not see the M.L.7 in action at all, and the Super 7 was engaged in the same operation all day; and not a very intricate one at that. I think that the makers, in well-remembered words "can do better."

After all that binding, some things I did enjoy :—

. . . The sight of J.N.M., armed with a soldering iron, bending over a vice mending the silver band of his pipe—and burning his fingers ! Even the "gods" are mortal.

. . . . the entertainment provided by the gentleman who tried his hand at a little turning on the M.L.8 and vanished in a shower of unintentional chips.

. . . Sitting at lunch at the next table to the fabulous E.T.W. and watching him despatch lunch with the same aplomb with which he might machine an intricate casting.

. . . Visiting the "M.E." stand; not because I was able to have the promised chat with the "lions," they were not there; but because a perfectly smashing brunette proffered me the current copy. I very nearly banged ninepence, but realised in time that the offer did not include the damsel—and I had the current copy anyway.

Forgive me if I take a final crack: Assuming that the venue is the same next year, how about loaning umbrellas against a small deposit perchance it should rain while one is in the hall ?

Yours faithfully,
G. WALLACE JACKSON.
Ferring-by-Sea.

HOME FOUNDRY WORK

DEAR SIR,—I have been very interested in the articles by Terry Aspin on iron founding in the backyard. Three years ago I started making my own castings; six months after that I began producing good castings equal to the trade product. I used similar plant to that which he describes, but my reason for writing this is that he appears to have experienced the same trouble that I had for six months, i.e., the difficulty of obtaining suitable sand. The following formula may save other readers many disappointments if they attempt this most fascinating aspect of our hobby.

Fine silica sand between 90-110 mesh sieve, 100 lb.

Wyoming Bentomite or Vulclay, 4 lb. coal dust, 6 lb.

Fuel oil, ¼ pint.

Water, 2 quarts.

Mix in the order given. If only non-ferrous metals are to be handled, omit the coal dust. If steel castings are to be attempted, use coarser sand about 80-90 mesh.

If the Bentomite is not availablle, fire-clay will serve, but as fire-claay in most parts of the world are coarser, about 6 lb. is usually necessary.

The above formula gives a sand that will hold up true with very light running, and is consequently very free ventilating.

Why did I start making my own castings ? First, the trade were at the time too busy to bother with modelmakers; second, when my models are finished, I can say they are all my own work.

Yours faithfully,
K. F. MAYFIELD.
King's Park, South Australia.

A LATHE MILLING ATTACHMENT

DEAR SIR,—In Fig. 22 page 25 of the issue July 2nd this year, there is an error. Part M, dimension 1 25/32 in. should read 2 25/32. Note, also, that in Fig. 15, the bevel pinion, is given as having 11 teeth. It has, of course, 22 teeth.

This last error is pretty obvious, because the text gives the correct number of teeth, but the error in Part M is not so easy to spot, and may cause trouble if not put right.

Yours faithfully,
Newbury. "DUPLEX"

KEY CUTTING

DEAR SIR, —With reference to Mr. E. Capps article on cutting cylinder latch keys, THE MODEL ENGINEER August 6th, I would like to point out to him that if he has any cylinders of which all the keys are lost and he took them to a real ironmonger, such as I work for, they would open the cylinder without filing the spring and plunger housing or any other part of the cylinder and cut one or more keys to it on a *proper* machine, all for say, 2s. 6d. the first key and 1s. 9d, subsequent keys required.

Readers must be careful, when buying key blanks, that they get the "correct blanks" for the latch (there are several hundred different ones on the market) and that not all keys are cut at the angle (105 deg.) as suggested. Also as an ironmongers' assistant, I would suggest that members leave key cutting and repairs to their local lock-smith or ironmonger.

Yours faithfully,
Hastings. P. KELLER.

L.B.S.C.'s "Britannia" in $3\frac{1}{2}$ in. Gauge

CONSTRUCTING THE TENDER BODY

IF the Recording Angel happened to be a shorthand-typist when on earth, and has faithfully recorded all the naughty things that I have thought and said about British Railways, the standard tender, and the good folk responsible for it, migosh— I " won't 'arf cop out " as the kiddies would remark, when I stand trial for my manifold sins and wickedness ! All the same, I shall hope for the best, and plead as extenuating circumstances, an honest endeavour to please the readers of this journal who are building *Britannia*. The more I've gone into matters, the more I am convinced that *Tugboat Annie's* tender would have filled the bill equally well, and been far easier to build both in the large and small sizes. However, as I said before, the design is no concern of mine. I'm just trying to do my best, to scheme out a little tender that looks like the full-sized article.

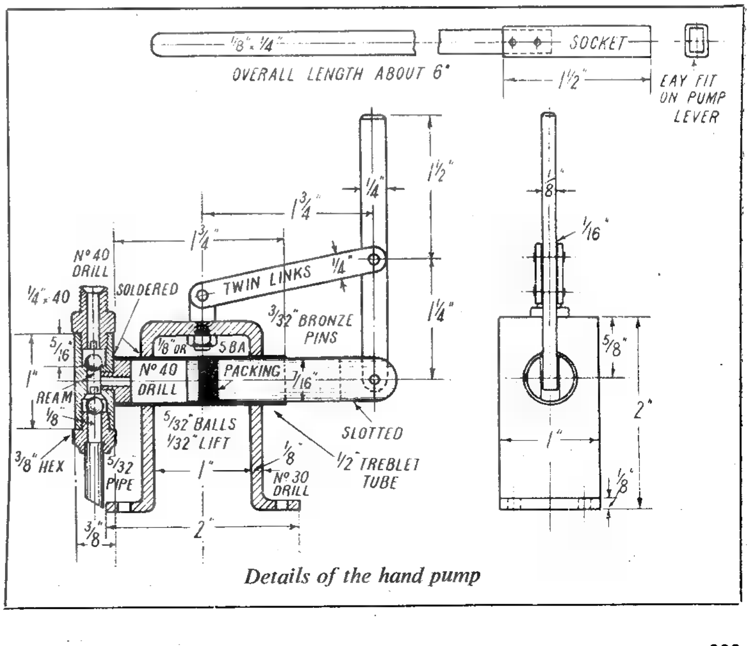
If a sheet of 18-gauge brass or copper measuring a minimum of $15\frac{1}{4}$ in. × $16\frac{1}{2}$ in. is available, the bottom, sides, and top bends can be made in one piece. Mark off the bending places, as shown in the front end view ; the bottom is $6\frac{1}{2}$ in. wide, sides 4 in. high to start of inward cant, and the cant itself as shown. I imagine that few builders will own a bending brake long enough to take the full length (mine only takes 12 in.) so the bends will have to be made over a bar in the bench vice. Take out the jaw insets, and put a piece of rectangular rod on the steps, leaving enough projecting at the side, to extend the full length of the tender body. Rest the marked line on the edge of the bar ; and a good hefty push downwards on the projecting metal, should form the bend with the needed slight radius, the exact amount of which doesn't matter as long as it looks all right. Don't assault the copper or brass with a hammer, If you *have* to persuade it, lay a piece of wood on it, and biff that to your heart's content.

To grip the upper edges, two pieces of bar will be needed, the metal being clamped between them, with a hefty clamp over the outer ends, to prevent their springing apart. In the days before I had any bending apparatus, I used two pieces of bar about 1 in. square, with a bolt through each end. The metal was put between the bars, and the bolts well tightened up, to grip the sheet firmly ; the bars were then gripped in the bench vice, and the projecting metal bent over.

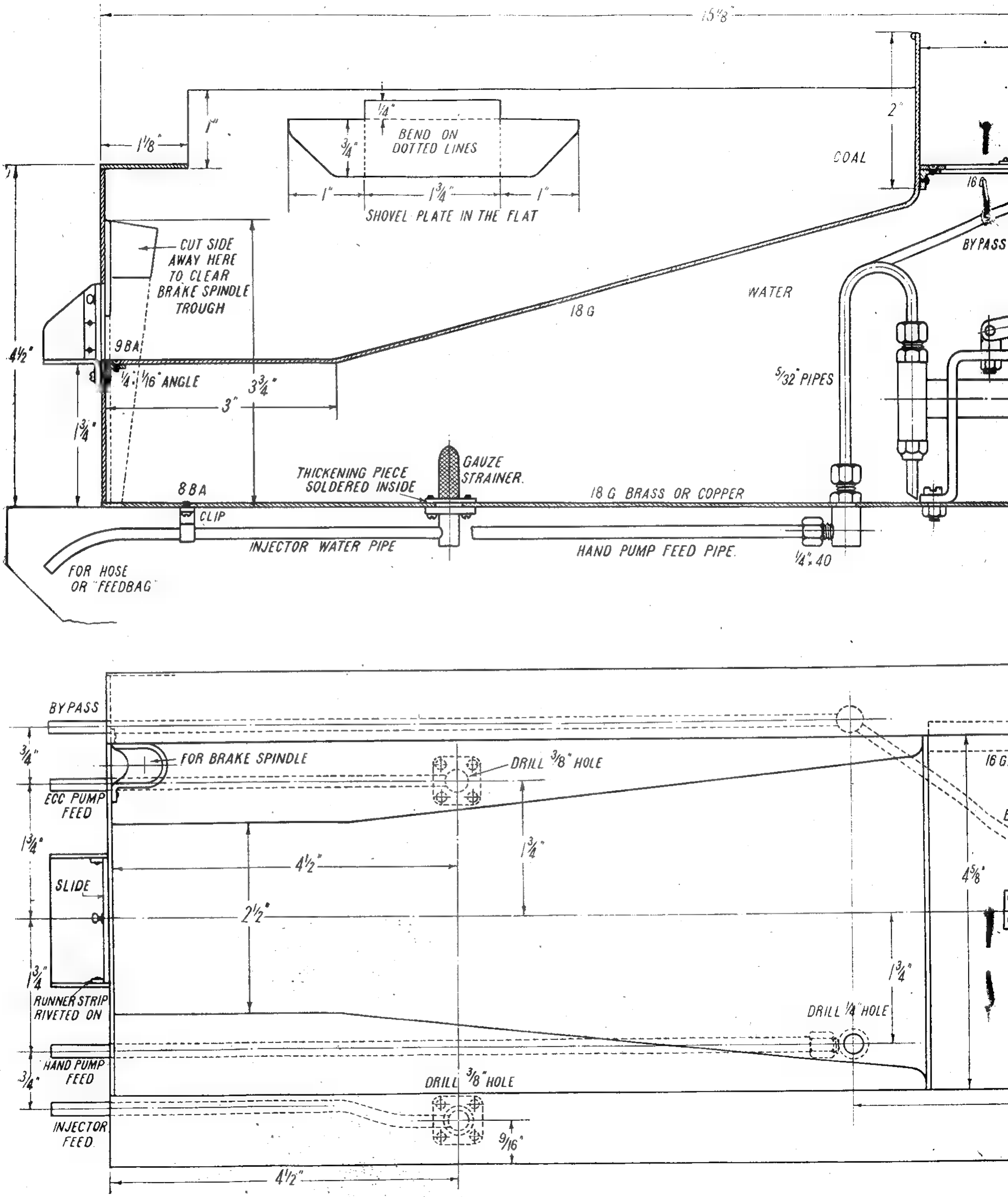
If a single sheet isn't available, and the body has to be made in two pieces, make the join in the middle of the bottom, butting the edges together, with a strip overlapping them full length, riveted and soldered in place.

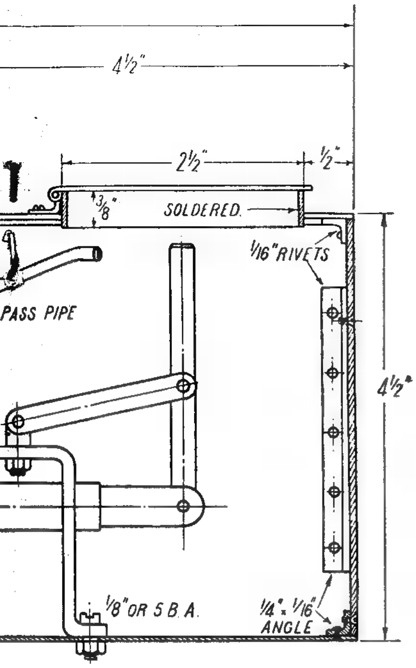
Four holes will be needed in the bottom, for the feed and bypass fittings. The two feed strainers are located $4\frac{1}{2}$ in. from the front end of the tender ; the right-hand one, for the eccentric-driven pump, is $1\frac{3}{4}$ in. off the centre-line, and the left-hand one, for the injector, is $\frac{9}{16}$ in. from the left side sheet, both shown in plan. Drill a $\frac{3}{8}$ in. hole at each point ; and over it, on the inside of the tank, solder ■ piece of 16-gauge sheet brass, $\frac{5}{8}$ in. square. This is to give a hold for the screws fixing the square flanges of the fittings. The $\frac{3}{8}$ in. holes are continued through these thickening pieces. The other holes, for the hand pump union and bypass fittings, are drilled in the location shown on the plan drawing, using $\frac{1}{4}$ in. clearing drill. No thickening plates are needed here, but file off any burring. The pieces of angle may be riveted on, at this stage, for fixing the coal hopper. These are obtuse (see end view) and may be bent up from sheet brass, in the bench vice. They are $9\frac{3}{8}$ in. long, and are riveted along the top of the canted-in part, starting at $1\frac{1}{8}$ in. from the front end of the body. Use $\frac{1}{16}$ in. rivets.

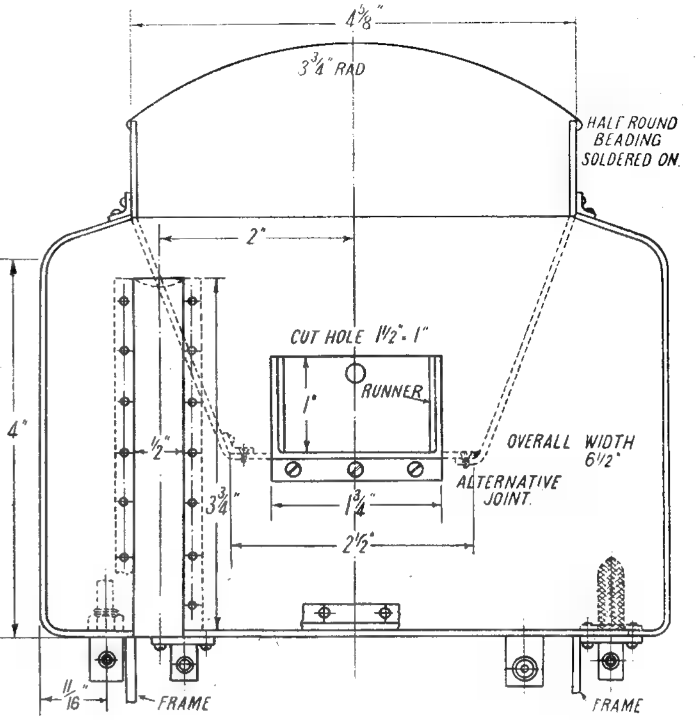
The end plates can be cut from the same kind of metal used for the tender body, to the shape and dimensions shown in the end view, less the thickness of the plate forming the sides and bottom. The back one is plain on the outside, but a piece of $\frac{1}{4}$ in. × $\frac{1}{16}$ in. angle will be needed inside, along the top edge, for attachment of the cover plate. This is riveted flush with the top, see side section. The front plate will need a hole for the coal gate, and a long slot for the brake spindle recess. This is to your left, when looking at the front of the tender, and is $3\frac{3}{4}$ in. long, and $\frac{1}{2}$ in. wide. It is closed in on the water side by a piece of 18- or 20-gauge brass or copper, bent to a trough shape, with a flange at each side. The two flanges are attached to the inner side of the front plate with a few $\frac{1}{16}$ in. rivets.



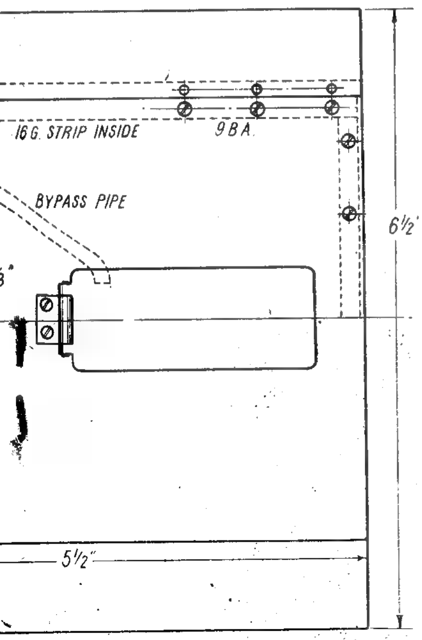
Details of the hand pump


15⅝"
1⅛"
1"
¼"
¾"
BEND ON
DOTTED LINES
1"
1¾"
1"
SHOVEL PLATE IN THE FLAT
2"
COAL
16G
BYPASS
CUT SIDE
AWAY HERE
TO CLEAR
BRAKE SPINDLE
TROUGH
WATER
18 G
4½"
9 BA
¼ · 1/16" ANGLE
3¾"
3"
5/32" PIPES
1¾"
GAUZE
STRAINER.
THICKENING PIECE
SOLDERED INSIDE
8 BA
18 G BRASS OR COPPER
CLIP
INJECTOR WATER PIPE
HAND PUMP FEED PIPE.
¼" × 40
FOR HOSE
OR "FEEDBAG"
BYPASS
¾"
FOR BRAKE SPINDLE
DRILL ⅜" HOLE
16 G
ECC PUMP
FEED
1¾"
4½"
1¾"
4⅝"
SLIDE
2½"
1¾"
1¾"
RUNNER STRIP
RIVETED ON
DRILL ¼" HOLE
HAND PUMP
FEED
¾"
DRILL ⅜" HOLE
INJECTOR
FEED.
9/16"
4½"





Section, plan and front end view of the tender body for the 3½-in. gauge "Britannia"



A make-up piece is fitted to the top ; and this, and the side flanges, are soldered over to make them watertight.

To make the trough, first cut the piece of sheet metal to the dimensions shown, then grip one side of it in the vice jaws, and bend to form the flange. Repeat operation on the other edge, then form the trough by bending the middle part over a piece of ½ in. round rod held in the vice, to the shape shown in the plan of tender. The difference in width of the piece, as cut out, at top and bottom, will give the correct taper of the trough when bent to shape. The brake spindle is sloped to the same angle.

At 1¾ in. from the bottom of the front plate, cut a hole 1½ in. wide and 1 in. high for the coal gate. In front of this is fitted a shovelling-plate, which can be made in one piece with the side wings. Cut out a piece of 18-gauge steel, to the size and shape shown inset in the section of the tender body. Bend the two sides up, and the back part down ; and at 1/16 in. from the back edge of each wing, rivet a strip of 18-gauge steel, about 5/32 in. wide, to form runners for the coal gate, as shown.

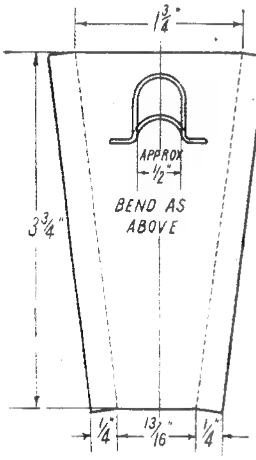
Next, cut a piece of ¼ in. × 1/16 in. brass angle, 1¾ in. long, or bend it up from 16-gauge brass. Drill three No. 48 holes through the back angle of the shovelling-plate, temporarily clamp it in position, and drill three corresponding holes through the front plate of the tender ; then put the piece of angle on the other side, at the bottom of the coal-gate opening. Temporarily fix it in place, make countersinks on it with a No. 48 drill, follow up with No. 53, drilling right through the angle, and tap 9 BA. Fix with brass screws, as shown in side and end views. The slide, or gate, is just a piece of 18-gauge steel 1 in. deep, and just wide enough to slide between the runners and the tender front. It is furnished with a knob for lifting ; this can be turned from a bit of nickel-bronze, or aluminium, with a pip on the back, to rivet into the slide.

Both ends can then be attached to the tender body. They are let in flush with the ends of the body, and soldered all around, but some reinforcement is needed ; this can be supplied by pieces of ¼ in. × 1/16 in. angle, riveted to bottom and sides of tank, just far enough in, to allow the ends to come flush. Attach

the ends to the angles by $\frac{1}{16}$ in. or 10 BA brass screws, and solder over the lot.

Coal Hopper or Bunker

I tried to wangle out how to bend this up from a single sheet, to avoid as many joints as possible ; but it can't be done without wasting a lot of material, and sheet brass costs muckle bawbees the noo, ye ken! Therefore, I'm showing the cheapest way of doing the job. This needs three pieces, but the joints are simple. The bottom joints can be made with pieces of obtuse angle bent from sheet brass, or the bottom edges of the side panels can be bent to form the angles, as shown in the end view ; the bottom of the hopper can be screwed and soldered to them.



Brake spindle trough

First cut out the two side panels to the shape and dimensions shown in the section of the tender body, and make the bends at 1 in. from the top, so that the sides cant in, as shown in the end view. If the construction shown at the right side is preferred, allow an extra $\frac{1}{4}$ in. on the depth of the side, when cutting out ; then, after bending the side cant, bend the bottom edge to form the flange. This bend extends right from the front end, to the upper edge of the sloping part. Put the two side pieces in place in the tender, and attach them temporarily with a small blob of solder at each end ; note that a nick will have to be cut at the front end of the right hand side, to enable it to bed down over the brake-spindle trough, see both end view and section. The exact size and shape of the bottom piece can then be easily obtained by cutting out a pattern from stiff paper or thin card-board. The back and bottom are all in one piece. When you get the pattern fitted O.K. cut a piece of 18-gauge sheet brass or copper to the same dimensions, and bend as shown ; then take out the sides of the hopper, and attach the bottom to them, either riveting or screwing direct, as shown at the right hand side, or joining with a piece of obtuse angle, shown at left hand side. Whichever method is employed, solder over the lot, to prevent water coming through. Rivet a piece of $\frac{1}{4}$ in. × $\frac{1}{16}$ in. angle outside, along the back, to form the front support for the removable part of the tank top, as shown in section of body.

Alternatively, the sides of the hopper could be left in place, and the bottom attached by screws, the joint being soldered over, as before ; but if it has been removed, as first described, replace it in the tank, making certain that the front end beds down on the bit of angle behind the shovelling-plate, to which it is attached by 9-BA.. countersunk brass screws. The top of the hopper should stand 1 in. above the top of the tank, and should be parallel with it. Rivet or screw it to the angle along the top of tank, and solder over the joints. A beading of 3/32 in. half-round nickel-bronze (german silver) wire, should be soldered all around the top of the hopper, to give a finish to the job. I left it bright on *Jeanie Deans*, and it looks fine ; copper or brass wire can be used if it is to be painted over.

Removable Tank Cover

The tank cover—thank goodness for small mercies!—can be made similar to those I have described for other tenders ; it is just a piece of 18-gauge brass sheet measuring $4\frac{1}{2}$ in. × $4\frac{5}{8}$ in. It should fit nicely in the space between sides and back of tank, and vertical part of hopper, resting on the ledges formed by the angles attached to the hopper, and the back sheet of the tank. At the sides, it is supported by two strips of 16-gauge brass, a full $\frac{3}{8}$ in. wide, or a bit wider, just as you fancy. These strips are riveted to the under-side of the curved-in part of the tank top—see dotted lines in plan drawing —using $\frac{1}{16}$ in. rivets at about $\frac{3}{4}$ in. centres. Scribe lines all around the cover plate at about 3/32 in. from the edges, and mark off and drill holes at approximately $\frac{3}{4}$ in. centres, along all four sides, using No. 48 drill. Put the cover plate temporarily in place, run the No. 48 drill through all the holes, to make countersinks on the strips and angles, following up with No. 53, drilling through, and tap 9-B.A.

Mark out a rectangle on the plate, measuring $2\frac{1}{2}$ in. × 1 in. with rounded corners, at $\frac{1}{2}$ in. from the back edge. Remove plate, cut out the piece, and bend up a strip of 18- or 20-gauge brass, $\frac{3}{8}$ in. wide, to fit the hole, putting the joint in the middle of the front end. Insert so that $\frac{1}{4}$ in. projects above the plate, and solder all around underneath. The lid can be made from 16- or 18-gauge brass, and is cut to the same shape, but about 1/32 in. bigger all around. Leave two tags at one end, about $\frac{1}{4}$ in long and $\frac{1}{8}$ in. wide, $\frac{1}{2}$ in. apart, and bend them into loops with a pair of roundnose pliers. Cut a piece of brass about $\frac{3}{4}$ in. long, to fit between, and bend the end into a loop likewise, making another bend at right-angles, a little below the loop. Put a piece of $\frac{1}{16}$ in. wire through the loops, to form a hinge pin ; drill two No. 48 holes through the horizontal part, put the lid on the filler, and attach the bottom part of hinge to tank top, by two 9-B.A. screws running through tapped holes in the plate, and locknutted underneath. These lids usually get slammed about anyhow, when the engine is in service, and the screws are liable to come loose unless locknutted or soldered over. Don't attach the tank top "for keeps" yet, as the hand pump has to be made and fitted.

Emergency Hand Pump

This is "a little bit of something that the big ones haven't got" ; fortunately they don't need it! Owing to the height of the tank, the pump shown is "a bit long in the legs," in a manner of speaking, in order to raise the pump barrel high enough to allow a reasonable stroke of the ram, when the extension handle is operated through the filler hole. The construction is just the same as my standard type. The stand is bent up from 1 in. × $\frac{1}{8}$ in. brass or copper, to shape and size shown, the hole for barrel being drilled $1\frac{1}{8}$ in. from bottom. Tip to beginners—if you put the stand on something level, and scratch a line across each end with a scribing-block, then centre-pop and drill at the middle of the scribed lines, the barrel will fit straight and level, instead of what the kiddies call "all bosky." Drill a pilot hole first, enlarge to 15/32 in. and finish off with the "lead" end of a $\frac{1}{2}$ in. parallel reamer, so that the barrel is a tight fit in the holes. Use No. 30 drill for the hole for anchor lug on top of stand, and the screwholes in the lugs.

The barrel is a piece of $\frac{1}{2}$ in. treblet tube $1\frac{3}{8}$ in. long. This should be perfectly smooth inside. If not available, ordinary brass tube may be

used, but the inside will probably need smoothing. Wind a bit of fine emery-cloth around a stick, to a loose fit in the tube; hold the end in three-jaw, and run the tube up and down the improvised lap with the lathe running like the turbine on the Great Western spinning-jenny. A plug $\frac{3}{16}$ in. long, with a 7/32 in. × 40 screwed pip on the end, and a No. 40 hole through it, is squeezed into one end. The valve box is made from $\frac{3}{8}$ in. round rod. Part off a 1 in. length, chuck in three-jaw, centre, drill through No. 34, open out and bottom to $\frac{5}{16}$ in. depth with 7/32 in. drill and D-bit, and tap $\frac{1}{4}$ in. × 40. Repeat operations on the other end, but don't use the D-bit; instead, nick the bottom of the hole with a small chisel. Drill a $\frac{3}{16}$ in. hole in the side, and tap 7/32 in. × 40. Poke a $\frac{1}{8}$ in. parallel reamer through the remnant of the No. 34 hole, and screw the valve box on to the spigot at the end of the barrel. Push the barrel through the holes in the stand, set the valve box vertical, with the D-bitted end at the top, adjust the barrel so that the projection from stand is equal at each end, and solder the joints.

Seat a 5/32 in. rustless ball on the bottom of the D-bitted hole, and measure depth from ball to top with a depth gauge. Chuck a bit of $\frac{3}{8}$ in. hexagon rod in three-jaw, face the end, and turn to $\frac{1}{4}$ in. diameter, for a length of 1/32 in. less than indicated by the depth gauge. Screw $\frac{1}{4}$ in. × 40, part off at $\frac{7}{16}$ in. from shoulder, reverse in chuck, turn $\frac{1}{4}$ in. length to $\frac{1}{4}$ in. diameter, screw $\frac{1}{4}$ in. × 40, countersink deeply, and put a No. 40 drill right through. Cross-nick the end with a thin file, and screw home, with ball on the seating. Put another ball in the other end, and take depth as before. Chuck the $\frac{3}{8}$ in. hexagon rod again, and turn and screw the outside as given above, to a length equal to that indicated by the gauge. Centre, drill No. 34 to $\frac{1}{2}$ in. depth, ream $\frac{1}{8}$ in., face 1/32 off the end, to form a true seating for the ball, and part off at $\frac{1}{4}$ in. from shoulder. Reverse in chuck, turn the outside as shown and counterbore for $\frac{1}{8}$ in. depth with No. 23 drill. Fit a $\frac{3}{4}$ in. length of 5/32 in. pipe into the counter bore, solder it, and bevel off the end as shown. Seat the ball on the faced end, and screw the fitting home in the bottom of the valve box.

The ram or plunger is a piece of $\frac{7}{16}$ in. bronze or rustless steel, 2 $\frac{3}{16}$ in. long. This should be a nice sliding fit in the barrel. If the exact size isn't available, turn a piece of $\frac{1}{2}$ in. rod to fit the barrel, and part off to given length. Turn a groove $\frac{3}{16}$ in. wide and $\frac{1}{8}$ in. deep at one end; cross-drill the other end with No. 43 drill, round it off, and cut a $\frac{1}{8}$ in. slot a full $\frac{9}{16}$ in. deep, to take the lever. This is done by the same method as given for slotting valve-gear forks and similar parts. The lever is a 3 in. length of $\frac{1}{4}$ in. × $\frac{1}{8}$ in. nickel-bronze rod, with two No. 41 holes drilled through it at the spacing shown. Slightly bevel off the top end, and round off the bottom. To make the anchor lug, chuck a piece of $\frac{1}{4}$ in. × $\frac{1}{8}$ in. brass rod truly in the four-jaw, face the end, and turn $\frac{1}{4}$ in. length to $\frac{1}{8}$ in. diameter, screwing $\frac{1}{8}$ in. or 5 B.A. Part off at $\frac{3}{8}$ in. from shoulder. At $\frac{1}{4}$ in. above shoulder, drill a No. 41 hole, and round off the end. Put the stem through hole in top of stand, and secure with a commercial brass nut. The connecting links are two $2\frac{1}{8}$ in. lengths of $\frac{1}{4}$ in. × $\frac{1}{16}$ in. nickel-bronze (or brass would do) drilled No. 43 at $1\frac{3}{4}$ in. centres; round off the ends. Put one at each side of the lever, opposite the upper hole, and pin with pieces of 3/32 in. bronze or rustless steel rod. If using the latter, be sure it IS rustless! Pin the bottom end of the lever in the slot in the ram, with a similar pin; pack the groove with a strand or two of unravelled hydraulic pump packing (graphited yarn can be used if the former isn't available), insert ram in barrel, and pin links to the anchor lug. The pin joints should be free, but not slack enough to allow the lever to flop about from side to side.

Stand the pump in the tank, so that when the lever is vertical, it is exactly under the middle of the filler hole; drill No. 30 holes through bottom of tank, using those in the lugs as guide, and fix with $\frac{1}{8}$ in. or 5-B.A. brass screws nutted underneath. A stiffening plate of 16-gauge hard brass, a little larger than the base of the pump, could with advantage be placed between the pump feet and the tank bottom, the screws passing through the lot. This would save any stressing of the tank bottom, by any pump-handle-waggler who is by way of being both vigorous and heavy-handed. I know two or three good folk who are that way inclined! The extension handle is a $4\frac{1}{2}$ in. length of $\frac{1}{8}$ in. × $\frac{1}{4}$ in. nickel-bronze (steel would do as well, as it isn't left in the water) with a socket $1\frac{1}{2}$ in. long on the end. The socket may be made of rectangular tube, which is a commercial article, or a bit of 16-gauge sheet brass bent around the handle, and silver-soldered. It should be an easy fit on the pump lever. Next job, another spot of plumbing.

American Three-Cylinder Locomotives

Arising out of our comments on three-cylinder locomotives, in "Smoke Rings" for February 5th, Mr. Cliff Blackstaffe, of Victoria, B.C., Canada, has written to give us some further views; he states: "Regarding the apparent failure of three-cylinder locomotives, I have talked with engineers who have run them on the Southern Pacific Railroad, and they don't like them. Apparently, due to the inclined centre cylinder jerking up and down to some extent, the engines slip a part of a turn each rev. I discredited this at first, as the angle is not very great; but I'm told that even at high speed, the exhaust will go off beat if they are working normally hard, but will steady up to an even purr the moment you feed a little sand. That's proof enough for me!

"This state of affairs is not good from a maintenance standpoint. These engines could tie up a road badly in case of a breakdown, as they had their leading axle cranked to give clearance to the centre-connecting-rod, when in the lowest position. Very ingenious; but if a leading side-rod broke, which necessitates removing the other side-rod, the centre connecting-rod must also be removed as, when the leading axle gets out of step, the centre rod would foul. The valve-gear then has to be dismantled and the valve centralised and blocked before the engine could be driven in.

"All this is too much for an engineer and fireman to do in a short time, and a busy road must not be tied up. You see, the engines cannot even be towed in without disconnecting.

"In North America there seems to be no need to resort to more than two cylinders. There are engines with 30 in. by 30 in. cylinders taking steam at 325 lb. pressure, from boilers capable of continuous evaporation of 90,000 lb. per hour, that can wheel nearly two miles of loaded coal cars (70 tons per car) at speeds of 50 m.p.h.; or a steel-coach passenger train at 85 m.p.h. So why bother with more cylinders?"

That, to us, seems a fairly strong condemnation of the three-cylinder arrangement; but conditions in America are very different from those in Europe and, especially, in Britain where three-cylinder engines have been more or less successful.

IN THE WORKSHOP

BY DUPLEX

A JIG-SAW MACHINE

RECENTLY, when making a camera with wooden parts as well as a $\frac{1}{4}$-plate enlarger, it was realised how much more easily this work could be done if some form of machine saw were used for cutting up the material to the exact size, and also for cutting out apertures in heavy-gauge, sheet metal.

Jig-saw or Band-saw

A band-saw was first considered, as these machines are quick-cutting and the blades can be accurately guided.

Reference to toolmakers' catalogues showed that these saw blades are supplied in 25 ft. lengths, and the initial outlay for saws of several different pitches, suitable for cutting a variety of materials, would, therefore, be somewhat costly.

Clearly, for an all-purpose machine for use in the small workshop, many different kinds of blades will be needed.

Cutting circular or rectangular apertures was also another problem, for in commercial practice the blade of the band-saw is first broken across, and a brazed or welded joint is then made after the blade has been threaded through a hole in the work.

For the latter purpose, some commercial machines are furnished with an electric welding attachment; but this rather costly equipment and method of working is hardly within the province of the ordinary, amateur workshop. On the other hand, the jig-saw seemed to offer many advantages and no difficulties of construction were anticipated.

Saw Blades

On the question of blades, a very extensive range of Eclipse saws is available, comprising thirty-three varieties of special jig-saw blades with milled teeth. These blades have tooth pitches of from seven to thirty-two to the inch, blade thicknesses of from 0.011 in. to 0.028 in., and vary in width from 0.035 in. to 0.25 in. In addition to these, there are ten sizes of Eclipse piercing saws and eight varieties of fret-saw blades, all of which could be used in a jig-saw for special work.

Round blades with spiral teeth will serve for cutting curves of very small radius which cannot be negotiated with a flat blade.

Moreover, jig-saw blades are moderate in price and they have been found to maintain their accurate cutting qualities during a long working life. For the small workshop therefore, the jig-saw would seem to be the more generally useful tool and its only disadvantage, if such it be, is that cutting is rather slower because of the idle return stroke, but the time so wasted is of little account where the object is accuracy rather than rapid output.

It so happened that there was no opportunity of examining a commercial machine, and the only guidance as to the design and construction was obtained from illustrations appearing in advertisements.

It would seem that the most usual and cheapest way of converting the rotary motion of the drive to the straight-line motion for the saw blade is by means of a Scotch crank. Although this device has the advantage of greatly shortening the overall length of the driving mechanism, the moving parts are somewhat

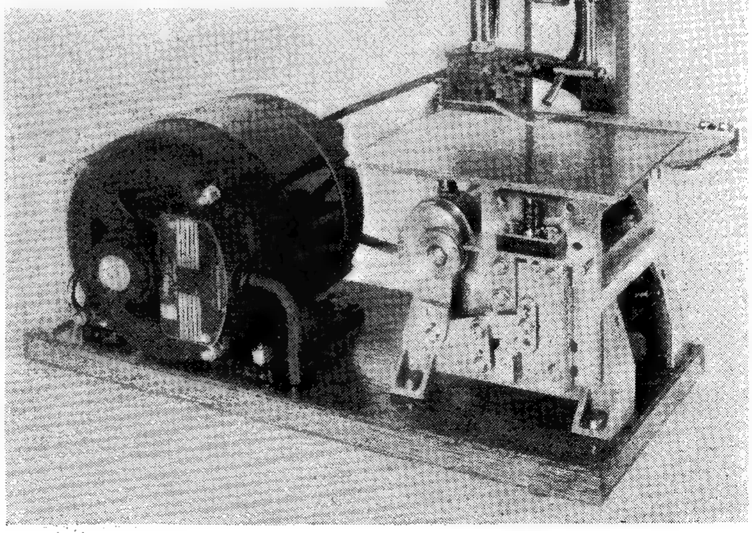


Fig. 1. The finished jig-saw machine

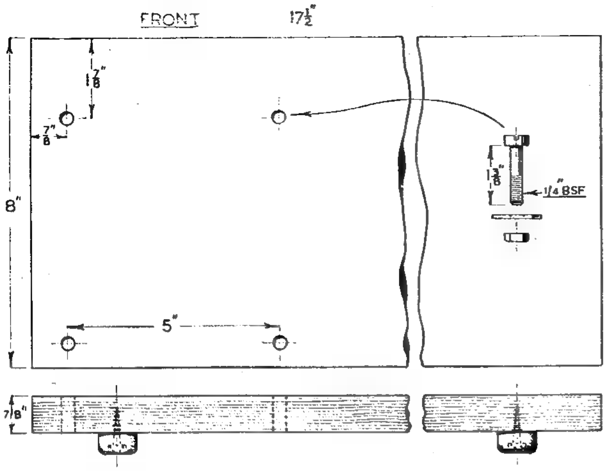


Fig. 2. The oak baseboard

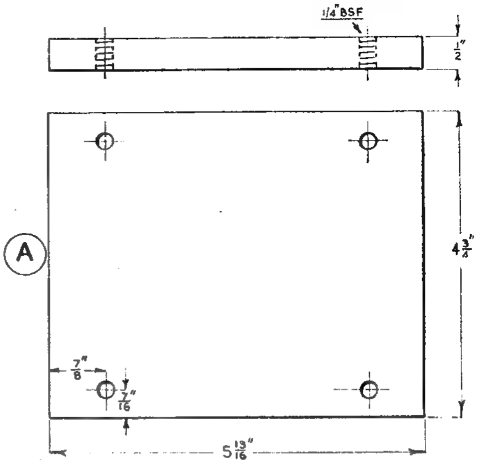


Fig. 3. The baseplate

liable to excessive wear. With a view to adopting a reliable form of construction, a design embodying a rocking beam was thought to have three main advantages: the overall height of the converting mechanism can be kept short without imposing excessive side thrust; the parts can, to a large extent, be kept in running balance without having to use inconvenient balance weights; the drive centres can be offset to reduce the side thrust on the slide-bars during the working stroke. The finished machine runs very smoothly even at high speed, and there is no noticeable noise from any part of the driving mechanism. Freedom from wear is ensured by case-hardening the steel working parts and providing for adequate lubrication. The saw blade can be easily changed or, when required, threaded through the work for internal cutting, and adjustable, hardened rollers serve to guide the blade as well as taking the cutting thrust.

Various attachments have been made, in the form of fences, for use when cutting either along or across the work. In addition, a mitring fence has been fitted for making built-up frames, and a circle-cutting attachment enables internal holes or discs to be sawn out. The fences are also furnished with an adjustable stop to enable a batch of parts to be cut to uniform length.

The tension of the saw blade is readily adjustable, and the usual form of air pump is fitted for blowing away any swarf tending to obscure a marked-out sawing line. A 1/6 h.p., self-contained, electric motor supplies ample driving power, and the V-belt drive is durable and quiet-running.

The castings for the bedplate brackets and the foot brackets are similar to those used in the bench hacksaw machine, and it is hoped that Mr. Haselgrove will be able to continue to supply these as well as other material needed.

As well as plastics, both light- and heavy-gauge sheet steel are readily sawn, and 1-in. oak is easily cut either along or across the grain. As a test, a cut, 1 in. in depth, was taken into a piece of mild-steel 1½ in. in thickness, but this is hardly fair to the machine, as the stroke of only 1 in. is not then sufficient to allow the swarf to fall clear from between the saw teeth.

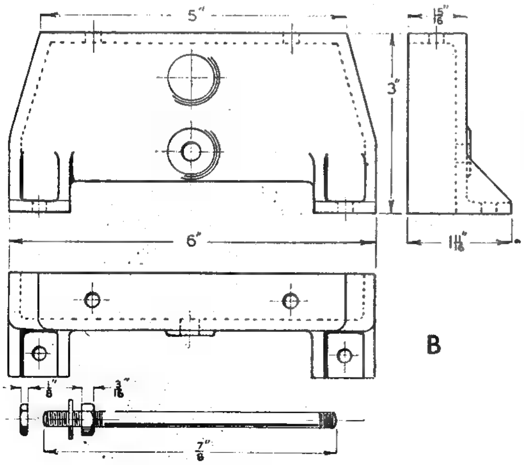


Fig. 4. The baseplate foot mountings

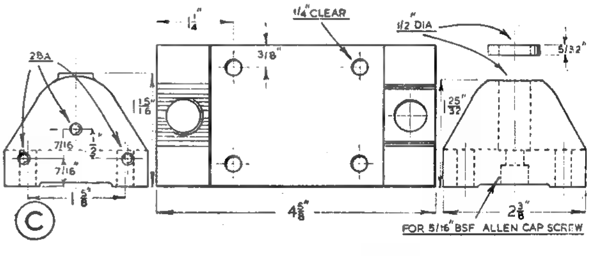


Fig. 6. The motion plate bracket

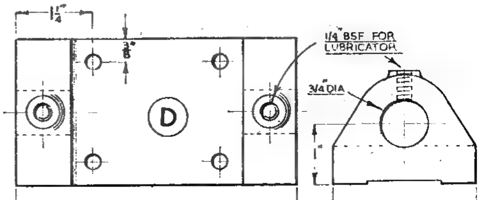


Fig. 7. The crankshaft bracket

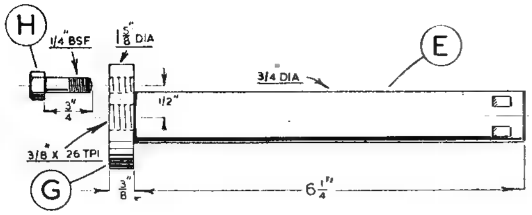


Fig. 9. The crankshaft E; the crank disc G; the crankpin H

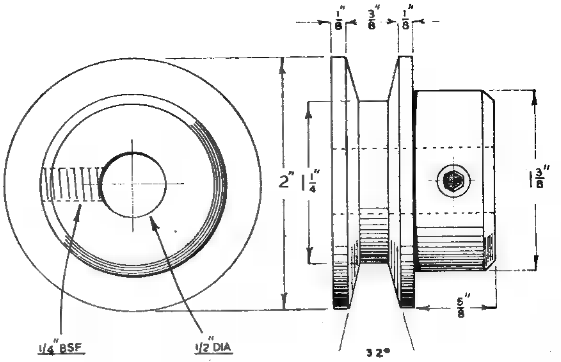


Fig. 11. (Right). The motor pulley

The wooden baseboard, Fig. 2, to which both the driving motor and the saw itself are bolted, can be finished at a later stage and a start made by building the driving mechanism of the machine.

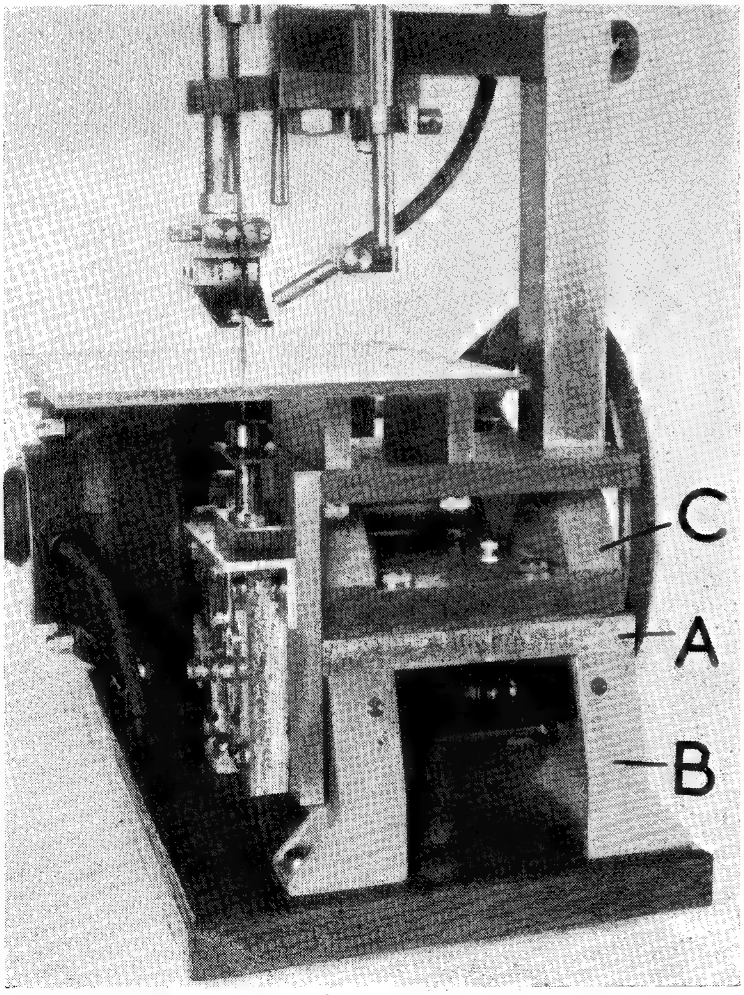


Fig. 5. The baseplate A; the foot mountings B; the motion plate bracket C

The Baseplate A

This part is made from ½-in. mild-steel plate or an aluminium alloy casting will serve.

Both the upper and lower surfaces should be filed or machined flat to provide a level seating for the two foot castings *B* and the two brackets *C* and *D*. The feet are then secured in place with screws inserted from below, and the stretcher-rod is fitted with its nutted end towards the rear.

The Baseplate Brackets C and D

These are both iron castings. The bracket *C* for the attachment of the motion plate *P*, to be described later, is filed or machined flat on its under side, and this is made easier by the presence of the two bolting strips on this face. One end of the casting must be filed truly flat and, at the same time, exactly square with the under surface in order to provide an accurate bolting face for the motion plate. Next, the upper surfaces of the two lugs are filed flat and parallel with the under surface of the base to form datum faces during the subsequent construction; but it should be noted that the lug at the rear is made 5/32 in. lower so that a ½ in. diameter hole can be drilled right through and finished to size with a reamer; a distance collar is then added to give a level seating.

The crankshaft bracket *D* is dealt with in the same way, but both end faces are formed flat and square with the base; in addition, the two lugs are bored, and finally lapped to a high finish, to provide bearings for the crankshaft.

The two brackets can now be secured to the baseplate with hexagon-headed screws or Allen cap screws, but care must be taken to mount them exactly parallel, and with their marked centre-lines at the correct distance apart. It will be seen that the bracket *D* is set to

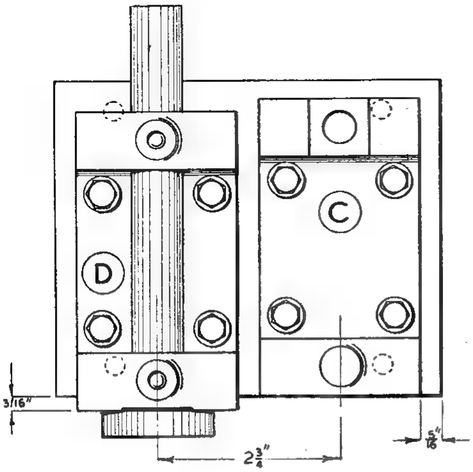


Fig. 8. Showing the two baseplate brackets mounted in place

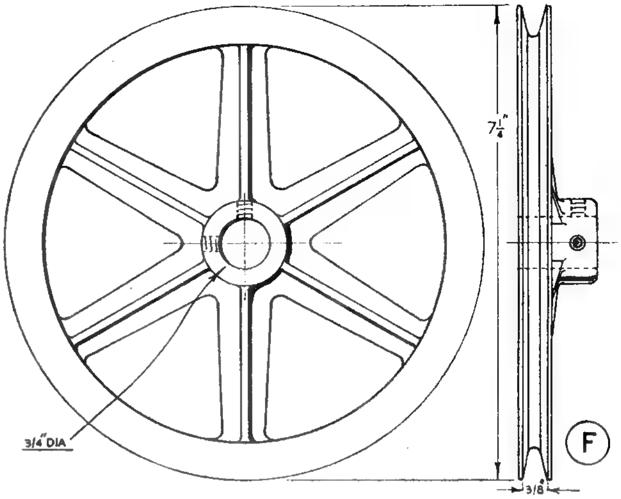


Fig. 10. The crankshaft pulley

project for $\frac{5}{16}$ in. beyond the front edge of the baseplate, but the bracket *C* lies flush. The easiest way, perhaps, of aligning the two brackets correctly, after they have been drilled, is to secure them in position on the baseplate with toolmaker's clamps so that the baseplate can be drilled and tapped by making use of the drill holes as a machining guide.

The Crankshaft E

Mild- or alloy-steel is used for this part. After the shouldered portion has been turned and screw-cut between centres, the journals are machined oversize preparatory to lapping them to a close running fit in the bearing bracket. Less work will be needed, when lapping to size, if the part of the shaft between the journals is reduced in diameter by a few thousandths of-an-inch.

To finish the crankshaft, two flats are filed at right-angles to one another to form seatings for the Allen grub-screws securing the pulley. The driving pulley *F* is a standard Myford lathe countershaft pulley, taking a Fenner V-belt, 30 in. in length and $\frac{3}{8}$ in. in width.

The steel disc forming the crank should be machined to a close fit on the threaded end of the shaft, although the direction of the drive is arranged to tighten both the disc and the pin when working.

The crankpin, securing the inner race of the ball-bearing fitted to the big-end of the connecting-rod, is not subjected to wear and, therefore, need not be hardened.

At this stage, the crankshaft can be mounted in its bearings and the pulley secured in place to take up any end-play. The bedplate, with its feet attached, is mounted on a wooden baseboard, together with the driving motor.

The motor pulley illustrated will drive the crankshaft at approximately 360 r.p.m.; this is adequate for sawing steel and will give sufficiently rapid cutting in wood, but if preferred, two-step pulleys can be fitted to give a higher speed when woodwork is mainly undertaken.

Oak is as good a wood as any for the baseboard, as, when properly seasoned, it is not liable to warp and will take a good finish with either french polish or linseed oil and furniture wax. It is a good plan to give the crankshaft a run when not under load and, if a copious supply of thin oil is fed to the bearings, any harmful metal particles detached from the bearing surfaces will be flushed out. Meanwhile, it is advisable to remove the shaft and clean the bearings several times, until only clean oil escapes.

(To be continued)

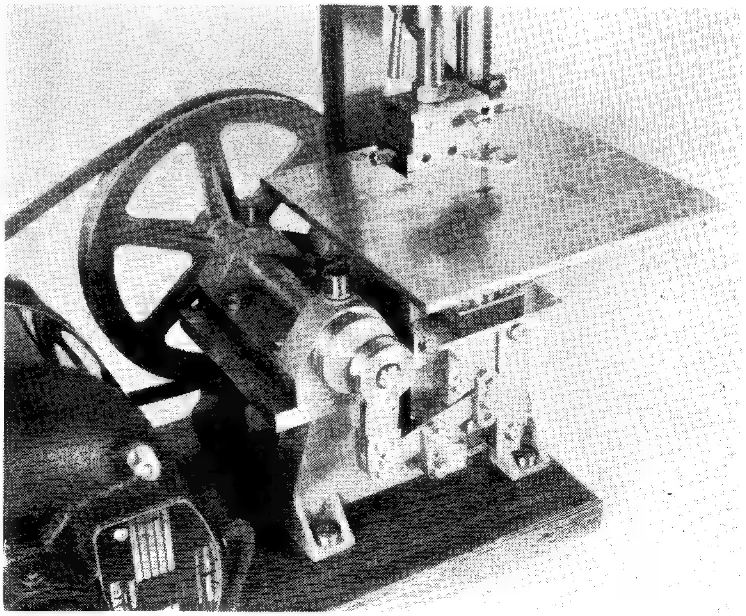


Fig. 12. View of the drive assembly

A Research MICROSCOPE

by Lawrence H. Sparey

THE original instrument was completed some considerable time ago, and has seen a great deal of practical use. During this period several modfications have suggested themselves to me, and I decided that if ever I should build another, some of the details would be slightly altered. In the design of the present instrument these alterations have been carried out, and as these articles have progressed I have rebuilt my own instrument to accord with the published design.

The design of the limb and foot has been altered ; some sharp edges have been blended into curves, and the appearance has been, on the whole, greatly improved. The reproduced photograph is of the microscope in its present form, and I think readers will agree that nothing has been lost by the alterations and simplifications.

The mechanical stage of the instrument has been the part most affected, as I came to the conclusion that such refinements as a ball-race bearing for the revolving stage were unnecessary, and only added complication with no corresponding gain. The new stage, therefore, revolves on a plain spigot-bearing.

One feature I have abandoned altogether. The original stage was revolved by means of a small knob, working a pinion and circular rack arrangement. Although good in theory, its practical application was very small, and certainly did not warrant the enormously difficult task of cutting a *circular, helical rack and pinion* ! After several attempts, with varying success, to cut these to the required perfection, I put the job aside, not because I believe it to be beyond practicability but because life is, after all, fairly short. The underside of my microscope stage does, indeed, still bear the tapped holes and milled apertures to which the arrangement was fitted, but these are certainly more bearable than a racking arrangement which was not in keeping with the rest of the instrument.

Continued from page 146, *July* 30, 1953.

The Mechanical, Revolving Stage

The *Concentric Revolving Mechanical Stage*—to give it its full name—consists essentially of two circular plates, the top one of which revolves upon the lower, which is attached to the limb of the instrument. The top plate carries Vee-slides, upon which the stage may slide in a forward and backward direction. This gives us two movements—rotary and back and forth—but there remains yet another, the cross movement from side to side. To obtain this, the whole stage does not move, but movement is confined to a small Vee-slide which is let into the stage, and carries the clips for holding the specimen-slide.

For reasons already stated, it was thought desirable that the top of the stage should present a plain, flat surface. Most mechanical stages have a raised block at the rear in which the cross-feed mechanism is housed. The present arrangement presents some difficulties in design and manufacture, in so far as the whole mechanism must be accommodated within a thickness of only one half-inch.

Stage Base Assembly

As may be seen from Fig. 15, nothing more than plain turning and milling is required on these components, and only two points should be noted. First, the locking ring *H*, should be a good tight fit on the spigot of the rotating plate *F*. The reason is that no other means are provided for locking this ring. If a nice fit is obtained in the first place, there is little danger of the components working loose, as the rotary movement required in operation is usually very small.

The second item refers to the machining of the chamfered edges of the plates. These should be completely finished and assembled together, except that the chamfers should be only roughly turned oversize. It is then possible to finish the chamfers on both plates together, thus ensuring that they coincide exactly. Should they not do so they will look very bad indeed.

It will also be noted that the male slides are of the built-up type, consisting of strips of $\frac{1}{8}$ in. brass which are screwed to the top plate. In machining the angles on these slides I found that the best method was to solder the strips to a larger piece of brass, to provide a holding piece. The same method was adopted for making all the necessary gib strips.

The Mechanical Stage

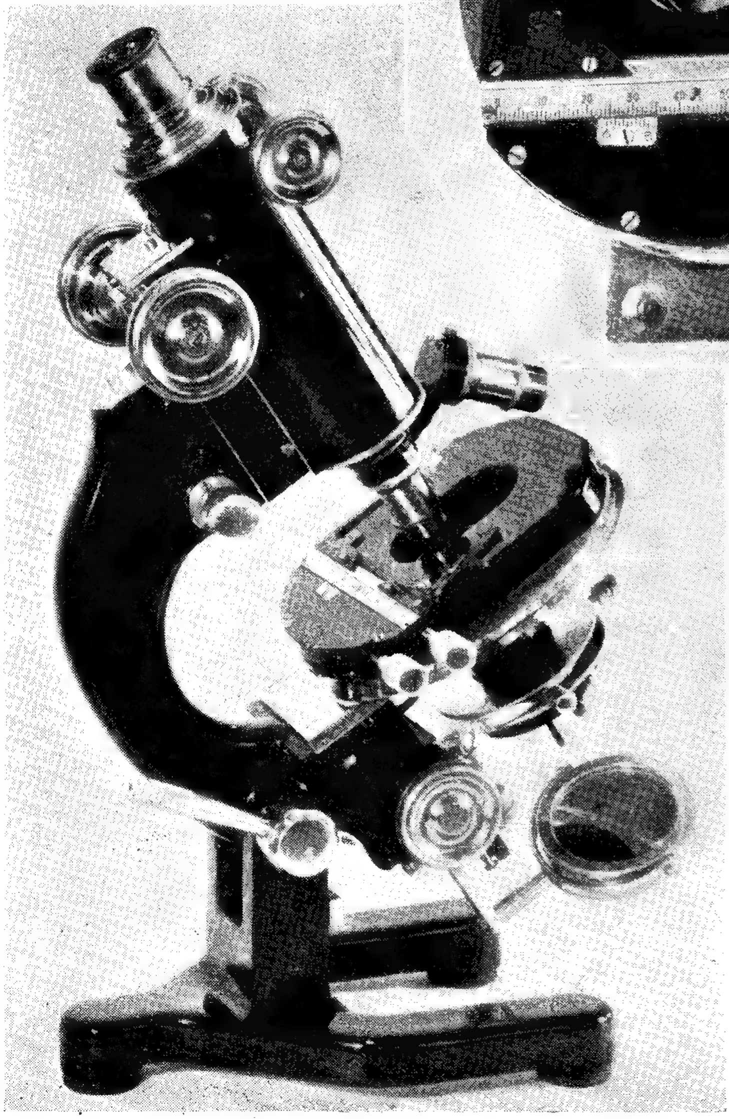
This is probably the most difficult component of the whole instrument to construct, and requires a considerable amount of accurate milling and drilling. The main body of the slide is made from a plate of hard brass, $\frac{3}{8}$ in. thick. To the top of this, two plates are screwed, thus concealing the milling, and providing the slides in which the small cross-slide operates. In this way we also obtain the split bearing for the pinion shaft which operates the forward and backward motion. Drawing (*A*), Fig. 16.

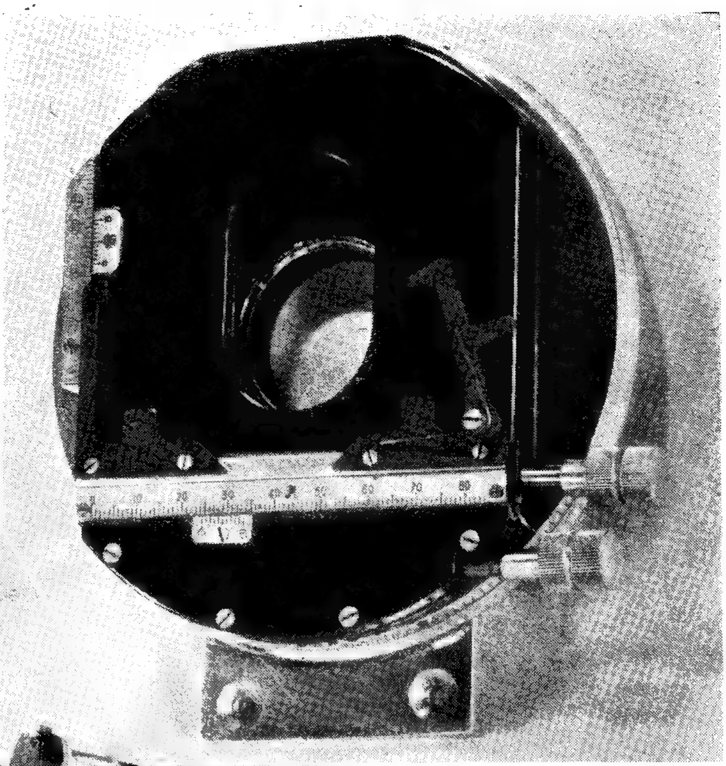
Before proceeding to a more detailed account of these movements, it is as well to draw attention to the small feed-screw and nut shown in the lower left-hand corner of Fig. 16. The screw is likely to provide a nice exercise in screwcutting, as it is a left-hand, square thread, two-start screw, of $\frac{1}{4}$ in. lead, cut on a piece of 5/32 in. mild-steel. On this diameter it is impracticable to cut the thread to the depth that is theoretically correct ; *i.e.* $\frac{1}{16}$ in. single depth, as this would leave a core diameter of only 1/32 in. A nominal thread depth of 1/32 in. has been specified, although the thread may be even shallower than this without any dire consequences, because the load is so exceedingly light. As a working note it may be mentioned that the width of the square threading tool must be $\frac{1}{16}$ in. with plenty of side clearance, and that the lathe must be geared to cut 4 t.p.i. As the thread is left-hand, cutting will commence at the chuck end of the job, and traverse towards the tailstock. Indexing for the two-starts is best done by chalking the changewheels.

After trying several methods of making the tiny two-start nut, I found that the best way was to make

a small, cup-shaped housing, as shown in the drawing. This cup is held by a screw to the cross-slide, and the whole slide is assembled in the body, with the feed-screw in position. White metal is then poured into the cup, around the feedscrew, which has previously been well blackened in the flame of a candle or oil lamp. The inside

As these articles have progressed, the microscope has been rebuilt to conform to certain modifications which experience has indicated. The picture below shows the instrument as now described in these pages





A view of the concentric rotating mechanical stage. The slide-clips and the Vernier scales are well shown

of the cup has also previously been tinned with solder.

It is likely that a good deal of the molten white metal will be spilled over and around the job but it will be found that this may be prised off sufficiently to enable the whole job to be taken down and cleaned up. Some difficulty may be found in persuading the white metal to flow into the cup and around the feed-screw, but it may be coaxed into place with a piece of red-hot silver-steel of $\frac{1}{16}$ in. diameter. Not a very difficult job altogether.

The method of assembly of the feedscrew within the plate will be seen in the enlarged drawing at the centre-bottom of Fig. 16. This is drawn as if viewed from the top, with the small cross-slide omitted for clarity. In assembling it is first necessary to slide the cross-slide into position, and secure the nut with a small countersunk screw. The feed-screw is then pushed into the bearing hole and screwed into the nut. When a sufficient amount of the 6-B.A. thread protrudes into the milled slot, the two lock-nuts and the spring

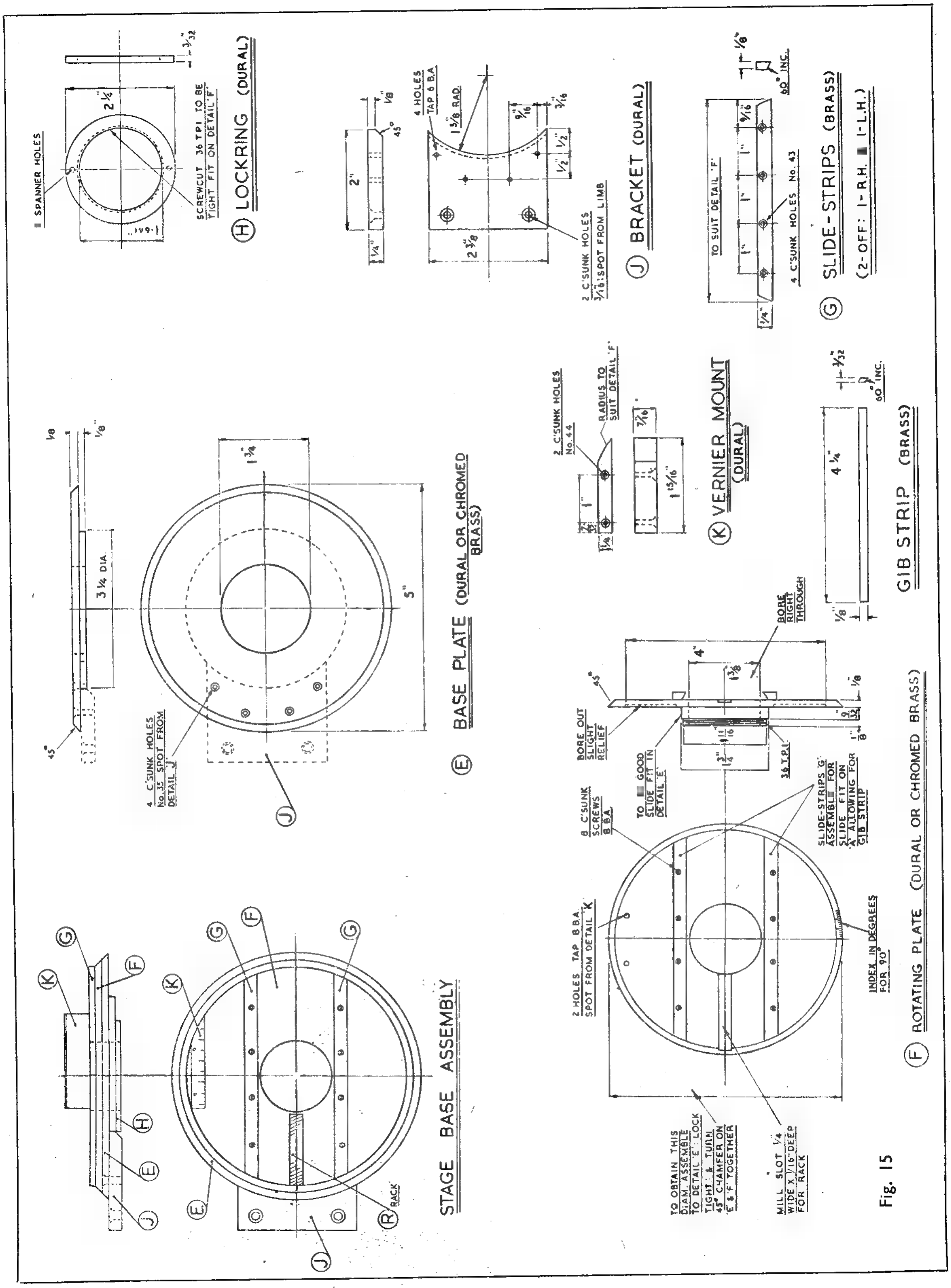

H LOCKRING (DURAL)
SPANNER HOLES
SCREWCUT 36 T.P.I. TO BE TIGHT FIT ON DETAIL 'F'
J BRACKET (DURAL)
4 HOLES TAP 6 B.A.
1 5/8 RAD.
2 C'SUNK HOLES 3/16: SPOT FROM LIMB
G SLIDE-STRIPS (BRASS)
(2-OFF: 1-R.H. 1-L.H.)
TO SUIT DETAIL 'F'
4 C'SUNK HOLES No. 43
60° INC.
E BASE PLATE (DURAL OR CHROMED BRASS)
3 1/4 DIA.
4 C'SUNK HOLES No. 35 SPOT FROM DETAIL 'J'
K VERNIER MOUNT (DURAL)
2 C'SUNK HOLES No. 44
RADIUS TO SUIT DETAIL 'F'
GIB STRIP (BRASS)
STAGE BASE ASSEMBLY
RACK
F ROTATING PLATE (DURAL OR CHROMED BRASS)
BORE OUT SLIGHT RELIEF
BORE RIGHT THROUGH
TO GOOD SLIDE FIT IN DETAIL 'E'
36 T.P.I.
8 C'SUNK SCREWS 8 B.A.
SLIDE-STRIPS 'G' ASSEMBLE FOR SLIDE FIT ON 'A' ALLOWING FOR GIB STRIP
2 HOLES TAP 8 B.A. SPOT FROM DETAIL 'K'
INDEX IN DEGREES FOR 90°
TO OBTAIN THIS DIAM. ASSEMBLE TO DETAIL 'E' LOCK TIGHT & TURN 45° CHAMFER ON 'E' & 'F' TOGETHER
MILL SLOT 1/4 WIDE x 1/16 DEEP FOR RACK

Fig. 15

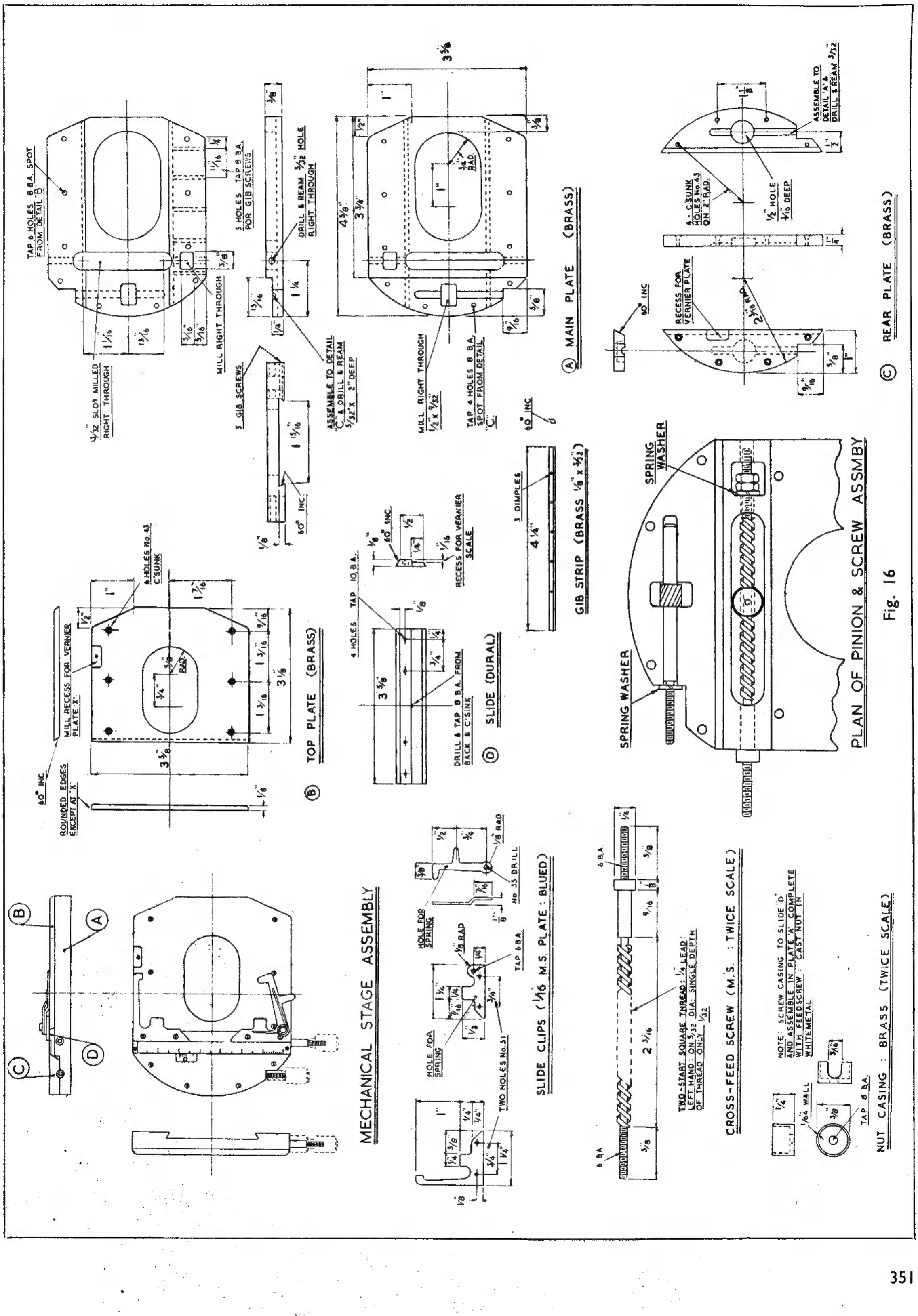

MECHANICAL STAGE ASSEMBLY
TOP PLATE (BRASS)
MAIN PLATE (BRASS)
REAR PLATE (BRASS)
SLIDE (DURAL)
GIB STRIP (BRASS 1/8" x 3/32)
SLIDE CLIPS (1/16 M.S. PLATE : BLUED)
CROSS-FEED SCREW (M.S. : TWICE SCALE)
NUT CASING : BRASS (TWICE SCALE)
PLAN OF PINION & SCREW ASSMBY

Fig. 16

washer are engaged. These lock-nuts are then adjusted until there is no side play on the feed screw.

This same drawing also shows the pinion and shaft in position. This is, of course, secured by the rear plate *C* which is screwed down on the top of it.

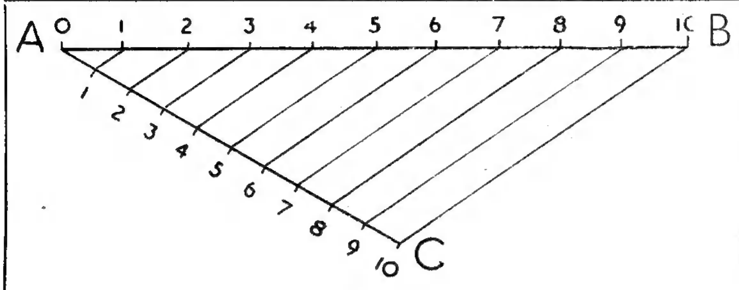


Fig. 17

Specimen-Slide Clips

Specimens to be viewed under the microscope are usually mounted to glass slides of a standard size of 3 in. by 1 in. and the clips of our instrument are arranged to take these. In the drawing of the mechanical stage assembly it will be seen that the left-hand clip is fixed, while the right-hand one is hinged and spring loaded to provide a firm grip. Both are screwed to the dural cross-slide *D*.

The clips are made from $\frac{1}{16}$-in. mild-steel plate, and they have a blued finish. This blueing is done by heating the finished clips to a red heat, and plunging them into a bath of ordinary lubricating oil. This gives a nice dull, blue-black finish, which is rust proof and durable.

The Vernier Scales

These may doubtless be obtained from dealers in microscope accessories, although I do not know of any specific source of supply. The scales fitted to my own instrument were given to me by an old instrument maker some time ago. More from fad than necessity, they replaced the home made verniers which were originally fitted, but I cannot say that they are any more efficient or ornamental.

Readers may be puzzled as to a method of making these verniers, so I will outline two systems, one of which I originally used ; but first, a word about the verniers themselves. Microscope verniers are invariably scaled in millimeters, and those fitted to my instrument read in tenths of a millimeter. This is arranged by having the long scales graduated in millimeters with the vernier plate divided into 10 *graduations over a distance of nine millimeters.*

Engraving Method

Very suitable millimeter scales may be had from ordinary rules, which may be cut down and trimmed to the necessary sizes. They may be obtained in stainless-steel, and also in white and transparent celluloid. A little "window shopping" around the tool shops and drawing equipment suppliers should be undertaken.

The vernier scale will not, of course, be obtainable in this way, and will have to be made in the workshop. This can be done by mounting a suitable plate on the cross-slide of the lathe, with a scribing tool suitably mounted on the headstock, and indexing by movement of the cross-slide feed screw. Ten divisions will be wanted in an overall length of 9 mm.; thus, the space between each division will be 0.0354 in.

The Photographic Method

Those builders owning a photographic enlarger will find no difficulty in making the verniers by the same method that I used myself. The millimeter scale was drawn out on white paper with black drawing ink, at three times scale;—that is, each "millimeter" division was 3 millimeters long. The vernier scale was also similarly set out, but in this instance, it was drawn very much larger, so that each millimeter became a centimeter. This helps to avoid errors. The drawings were then photographed to any convenient size, so that negatives were obtained. These were then placed in the enlarger and focussed up until the vernier was exactly 9 mm. long ; the scale was also brought to size. In this way one can print off as many scales as may be, and the best selected for final use.

In order to obtain a clear black and white image, "process" plates, such as are used for photographic copying of documents, were used, and your photographic dealer will advise about the most suitable kind. Printing was done on an extra hard grade of bromide paper, using Johnson's Contrast developer throughout. This process yielded excellent and accurate scales and verniers, which were mounted to the stage of the microscope under slips of $\frac{1}{16}$ in. thick celluloid.

Those of you who intend to make your verniers in this way will forgive me for refreshing your memories as to the method of dividing the nine millimeter scale into ten equal parts, as shown in Fig. 17. The line *AC* is drawn to the exact length of the scale required—say 9 cm., and the line *AB* is drawn at any convenient angle. The line *AB* is then divided into ten convenient divisions—say $\frac{1}{2}$ in. apart. Points *B* and *C* are then joined by a line, and other lines parallel to this are taken from the remaining 9 divisions on line *AB* to line *AC*, which will then be equally divided into ten parts. Just ordinary fourth-form stuff that we all so quickly forget !

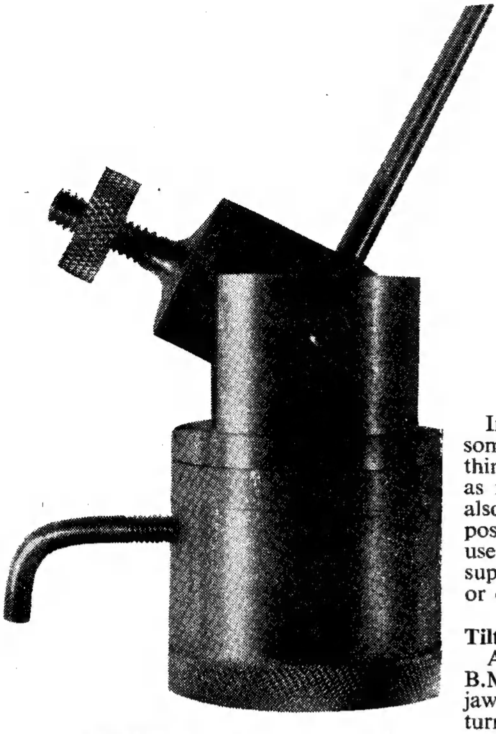
(To be continued)

PRECISION-MADE B.A. SCREWS

Kennion Bros. (Hertford) Ltd., have sent us some samples of their precision-made hexagon steel screws, with nuts and washers. These are available in a useful range of sizes, comprising 5, 6, 7, 8, 9, 10 and 12 B.A. We find that the standard of excellence is not only high, but is consistantly maintained from the largest to the smallest size. The lengths are varied from $\frac{1}{2}$ in. to $\frac{1}{4}$ in., and we note that the fit of the nuts on the screws is very satisfactory in all sizes.

Incidentally, the thread of each nut is slightly recessed at one end to assist the entry of the screw. We can recommend these products with every confidence.

We have been asked to state that the Kennion catalogue, recently noticed in our pages, is forwarded free upon receipt of a stamped addressed envelope.



A Pan-and-Tilt Tripod Head

By J. A. Keily

I HAVE long been of the opinion that the only type of camera really suitable for photography in the workshop is the triple-extension plate camera, but I think that it should be somewhat more portable than the one recently described in THE MODEL ENGINEER. However, on no account must rigidity be sacrificed, so when my so-called "Universal" camera was completed, it became obvious that a really firm tripod, equipped with a completely adjustable head, must be designed and made—for surely no model engineer worthy of the name would *buy* one ?

Ball-and-socket types of head were out of the question. I have never been convinced that they will support anything but a lightweight camera, however large they happen to be, and the usual workshop camera is no lightweight job ! So a pan-and-tilt it had to be.

The only part of the design that presented any difficulty was the "pan" i.e., the rotating base. Eventually, I decided on a split-collar fixing, as on many lathe tailstocks, including the one on which the machining of the original was done, a Myford-Drummond "M."

Had any been available, I should have used duralumin for the larger parts of the device, resulting in a large saving in weight; but bright mild-steel was used, bringing the weight to 1¾ lb., and this seems very satisfactory.

Indeed, after using the head for some little time, I am inclined to think that the weight is an advantage, as it steadies the set-up; and, due also to the large base diameter, it is possible, with a very light camera, to use the head without a tripod, for supporting the camera on a table, or other flat surface.

Tilting Block—Detail 2

A 2½ in. length of 1 in. square B.M.S. was chucked in the four-jaw, faced, and the last inch turned down to ¼ in. diameter, and threaded ¼-in. B.S.W. The other faces were then machined all over, and the pivot-hole drilled letter "F." The piece was then turned through 90 deg. and another hole drilled into the first, and tapped $\frac{3}{16}$-in. B.S.F., for the handle. The base was then filed to a smooth curve, and the whole was polished.

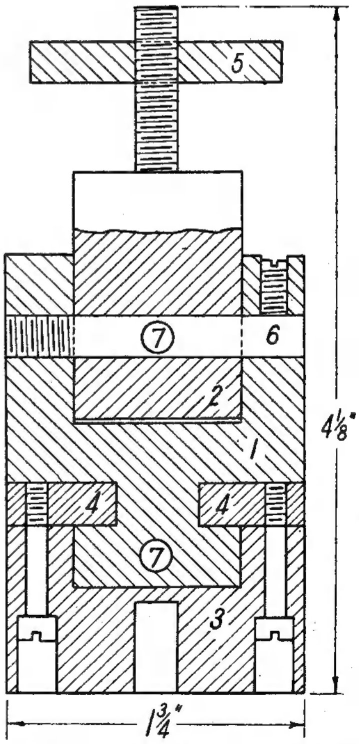
Upper Body—Detail 1

This was made from a 2 in. length of 2 in. diameter B.M.S. bar. This was faced, turned to 1¾ in. diameter, and a length of ⅝ in. was then turned down to exactly one inch diameter. On the accuracy of this diameter depends the smooth working of the finished apparatus. A keen parting-tool was then used to turn the under-cut, to a depth and length of ¼ in. After reversing in the chuck, taking care to grip the body, and not the one-inch part, the top was faced off. A large amount of metal was removed from the gap by drilling and boring to one inch, down to a depth of one inch. The piece was then held sideways in the four-jaw, and drilled right through tapping size for ¼-in. B.S.F., the nearer hole then being opened out to clearance size.

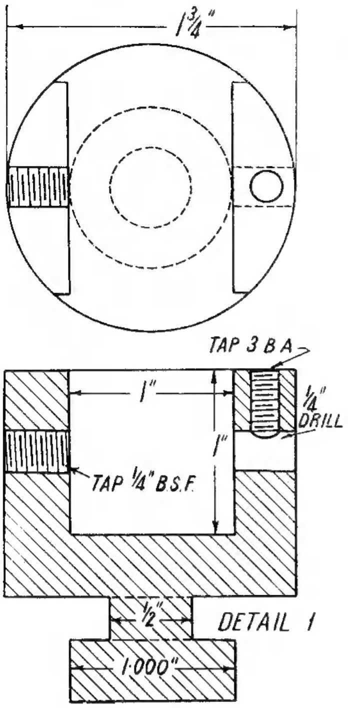
Now the gap for the tilting block had to be filed. This took me about five hours ! I now realise that a great deal more waste could have been removed by sawing first. The 3-B.A. grub-screw hole was drilled and tapped, and the block polished.

Lower Body—Detail 3

This was a relatively simple piece of lathe-work. A one inch length of 2-in. B.M.S. bar was turned down to 1¾ in. diameter, faced, and bored to a depth of ⅜ in., to a diameter of 1.001 in. It was then reversed, to be drilled and tapped ¼ in. B.S.W. for the tripod. To drill the four screw-holes, the piece was held eccentrically in the four-jaw. The holes were counter-bored for the 3-B.A. cheese-head



Sectional sketch of the pan-and-tilt tripod head

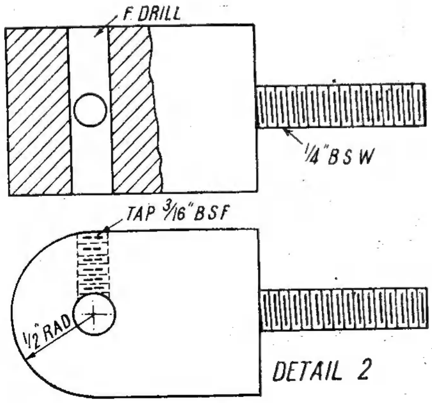


DETAIL 1

screws. The unit was then held sideways to drill, and to tap $\frac{3}{16}$-in. B.S.F., the hole for the locking-screw.

Split Collar—Detail 4

This was straightforward. A disc of 2 in. diameter from a brass bar was faced to a thickness of $\frac{1}{4}$ in., and drilled and bored to $\frac{1}{2}$ in. + 1 thou. The disc was then held on a mandrel, and turned to a diameter of $1\frac{3}{4}$ in. It was slit down the centre with a Junior hacksaw, being the thinnest blade available, and smoothed with a fine file. As yet, the screw-holes were left alone.



DETAIL 2

Pivot—Detail 6

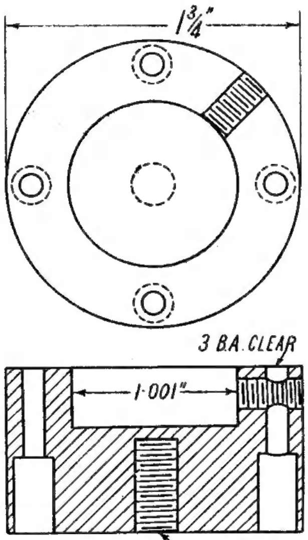
The pivot was a length of $\frac{1}{4}$-in. silver-steel, screwed $\frac{1}{4}$-in. B.S.F. for $\frac{3}{8}$ in., and has a small flat filed to take the grub-screw.

Clamp-ring—5 and Locking-screws—7

It will be noticed that no dimensions are given for these parts, as they vary according to the camera with which the apparatus is to be used. In my case, I made two clamp-rings, one $\frac{3}{4}$ in. diameter, and the other $1\frac{1}{2}$ in., both of brass, $\frac{1}{4}$ in. thick. The locking-screws are both of $\frac{3}{16}$-in. silver-steel, screwed $\frac{3}{16}$-in. B.S.F., one, for the "Pan" locking, being 2 in. long; and the other, for the "Tilt" locking, being 12 in. long, thus forming the handle.

Assembly

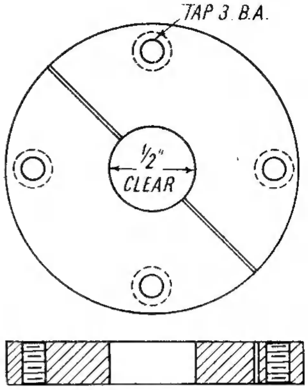
After filing the burrs off the half-



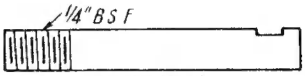
DETAIL 3

rings 4, they were clamped in place round the projecting part of the upper body, which was then placed in the lower part 3. The holes for the 3-B.A. screws were then drilled and tapped, the swarf removed, all parts liberally greased, and then reassembled with the screws. The tilting block was then fitted into place with the pivot, which was locked by the 3-B.A. grub-screw.

As, in use, it was found that the "pan" assembly



DETAIL 4



DETAIL 6

turned somewhat stiffly, the mating surfaces were ground together with a smear of fine carborundum paste. After a thorough cleaning, the space between the surfaces was filled with a light grease, by alternatively filling the tripod screw-hole with grease, and forcing in a $\frac{1}{4}$ in. BSW screw. The screw-hole was connected to the working parts for this purpose by drilling through, No. 60.

To finish, the base and clamping rings were covered with discs of felt, to protect the tripod and camera respectively.

The heading photograph was taken with the "Universal" camera, using a mock-up tripod head held in a small vice.

Bellows

The camera, incidentally, is on a mono-rail base, which is made of $\frac{1}{2}$-in. copper tubing. The bellows were folded from book-cloth, rendered light-tight with matt black varnish. They extend to eighteen inches, so that, with a four-inch lens, it is possible to focus down to five inches. The lens fitted at present is a 98 mm. f.7.9 RR. lens by Kodak, in a shutter which has seen better days. As both the front and back units can tilt and swing, rise and drop front are (I think) superfluous. Plates $2\frac{1}{2}$ in. $\times$ $3\frac{1}{2}$ in. are used, to cut expense to a minimum. The total cost of the camera, without lens and shutter, was in the region of thirty shillings.